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THE

NATIONAL CYCLOPEDIA:

A

DICTIONARY OF USEFUL AND PRACTICAL INFORMATION

FOR THE

FARM, HOME AND SCHOOL.

BY

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THE NATIONAL CYCLOPEDIA.

GABLE The triangular piece of wall at the ends of a house, immediately under the roof.

GADFLY. This is the name of the bot-fly, (*Æstrus equi*) producing the bot-grub in horses, and also of the sheep bots, or fly, (*Æstrus ovis*) producing grubs in the heads of sheep, or head maggots, as they are sometimes called. (See article Bots, and also Sheep.) The large, black gad, or horse fly, (*Tabanidæ*) are dreadfully troublesome to horses in some seasons, especially in the West and South. The green head, a smaller fly, is so rapacious in the prairie regions in the West, that it is impossible to manage a team with any comfort in driving, except they are completely covered with netting. A still smaller species, the golden-eyed forest-fly, (*Chrysops*), called ear-fly in the West, will sometimes render animals frantic. As a means of securing exemption, the head, neck and ears of horses should be carefully covered. The skin bot-fly (*Æstrus bovis*), is often annoying to both horses and cattle in the South and West, from their habit of depositing the eggs, one in a place, in the backs of horses, and especially cattle, which, hatching, live on the integuments under the skin, emerging in the spring. They may be felt in the winter as hard lumps. The opening should be slightly enlarged with a lancet, and the grub squeezed out by pressure on each side. Then wash the wounds clean with a tincture of aloes and myrrh, and the abscesses will soon heal.

GADFLY, BREEZE. Dipterous insects of the genus *Æstrus*. These insects nearly resemble bot-flies; they deposit their eggs under the skin of animals, which they pierce, giving considerable pain. They are nearly if not identical with the skin bot-fly.

GAGE, GAUGE. In physics, an instrument to measure any result, as wind-gage, rain-gage.

GALBANUM. *Galbanum officinale.* An umbelliferous herb of Africa. A fetid gum resin exudes spontaneously from it having antispasmodic properties.

GALBULA. A genus of climbing birds like king-fishers; they live in wet forests and are insectivorous.

GALBULUS. A fruit of a rounded form, but with an internal conical arrangement of the carpels; as that of the savin, juniper, and yew.

GALEATE. Helmet-shaped. In botany, the term is applied to the upper arched lip of personate flowers.

GALERUCA. A genus of coleopterous insects, the type of the *Galerucidæ*, including the *Haltica*. They are vegetable feeders in the perfect and larva state. The yellow-striped squash beetle (*G. vitata*) is of this genus.

GALLINACEOUS. Birds resembling the domestic cock, as turkeys, pheasants, pigeons.

GALLIZING. Adding sugar and water to the must of grapes containing too large a proportion of acid and tannin, as the Concord and Clinton, and fermenting it therewith is called Gallizing, after its inventor, Dr. Gall. Another means, adding sugar and water to the husks, after the first pressing (and then fermenting), is called Chaptalizing, after its inventor, Chaptal. In Gallizing the juice of grapes, or in Chaptalizing, the husks, after pressing, are taken; the idea being to add water and sugar sufficient to bring the specific gravity up to eighty degrees of Œchsle's saccharometer, and so it shall contain four per mill acid, by Geisle's acidimeter. Fifty gallons of water to 100 gallons of mashed grapes and two pounds of best crushed sugar to the gallon of water, is one formula. Test the mixture and if the weight is between eighty degrees and ninety degrees, press immediately without fermenting the husks. If the grapes are very ripe, they may require less, if unripe, and very acid, more. The husks may be afterward Chaptalized, by adding water and sugar to the husks to make it weigh eighty degrees as strained juice. Then ferment on the husks from twenty-four to forty-eight hours according to the temperature, or more or less violent fermentation. The making of cider wine is precisely after the same process. The apple juice is augmented with sugar and water, the resulting liquid to be of a standard of seventy to eighty degrees according to the strength required. Currants, gooseberries, raspberries, blackberries, strawberries and tomatoes, and the crushed stalks of rhubarb, can be made into most palatable wine, by Gallizing, as directed for cider, and as applied to American grapes the result has been most excellent wine.

GALLON. The imperial measure contains 277 274 inches, or ten pounds of distilled water at 62° Fahr. It is equal to four quarts, or eight pints. The old wine gallon contained 231 cubic inches; the beer gallon, 282 cubic inches. Each of these standards is used in different States. The half peck is a gallon in dry measure.

GALLOWAY. A pony of thirteen to fourteen hands. Originally, a small breed of horses A variety of Scotch cattle.

GALLOWAY CATTLE. It is more than probable that representatives of this hornless race of cattle were early brought to America by the English and Scotch settlers since, as a boy, we often found this blood cropping out in what were then termed Muley cows, and, as a rule, they were better than average milkers, and generally brown or black. About the year 1850 Galloways were imported into Canada, where they were carefully bred, and from whence they have been disseminated through the West, herds of them being not now uncommon at our yearly State Fairs, being much liked in the colder districts of country for their docility, hardiness and feeding qualities. The Galloway constitutes one of the most important breeds in Scotland, and made its appearance in the Lowlands within the last hundred years. Up to that time the cattle of the country were chiefly horned, like the rest of the Highland Scots. Since then the polled beasts, of which there were some even then, have gradually supplanted the horned breed, being much preferred by the English graziers as being more docile and kindly feeders. About the time of the general revival in agriculture, Lord Selkirk had his attention drawn toward the improvement of the stock of his own county, and he began his experiments upon the polled breed, and by selection and care raised it to the most prominent position among the Scotch cattle. Since his day many good breeders have continued the work, and brought them to the high state of perfection in which we now find them. Youatt thus describes the Galloway of his day and date: They are straight and broad in the back, and nearly level from the head to the rump. They are round in the ribs, and also between the shoulders and the ribs, and the ribs and the loin. They are broad in the loin, without large projecting (hip) bones. In roundness of barrel and fulness of rib they will compare with any breed, and also in the proportion which the loins bear to the hook bones or protuberances of the ribs. The Rev. Mr. Smith, the author of the Survey of Galloway, says that when viewed from above the whole body appears beautifully rounded, like the longitudinal section of a roller. They are long in the quarters and ribs, and deep in the chest, but not broad in the twist. The slightest inspection will show that there is less space between the hip bones and the ribs than in most other breeds, a consideration of much importance, for the advantage of length of carcass consists in the animal being well ribbed home, or as little span as possible lost in the flank. The Galloway is short in the leg and moderately fine in the shank bones; the happy medium seems to be preserved in the leg, which secures hardihood and a disposition to fatten. With the same cleanness and shortness of shank there is no breed so muscular above the knee, while there is more room for the deep, broad, capacious chest. He is clean, not fine and slender, but well-proportioned in the neck and chops; a thin and delicate neck would not correspond with the broad shoulders, deep chest, and close, compact form of the breed. The neck of the Galloway bull is thick almost to a fault. The head is rather heavy, the eyes are not prominent, and the ears are large, rough, and full of long hairs on the inside. The Galloway is covered with a loose, mellow skin of medium thickness, and which is clothed with long, soft, silky hair. The skin is thinner than that of the Leicestershire, but not so fine as the hide of the improved Durham breed; but it handles soft and kindly. Even on the moorland farms, where the cattle, during the greater part of the year, are fed on the scantiest fare, it is remarkable how little their hides indicate the privations they endure. The prevailing and fashionable color is black; a few are of a dark brindled brown, and still fewer speckled with white spots, and some of them are of a dun or drab color, perhaps acquired from a cross with the Suffolk cattle. Dark colors are uniformly preferred, from the belief that they indicate hardiness of constitution. The Galloway is essentially the grazier's beast, being little fitted for the dairy, though the milk is rich. Great numbers of heifers are spayed, and then make superior fat animals. The calves are allowed to suck their dams for some time, until they begin to eat, when they are gradually weaned by allowing them to suck but two teats, while the other two are being milked. When the milk is finally discontinued they are turned onto fresh grass. They are well kept the first winter, the Galloway farmer believing that if once checked at that age in their growth they rarely attain the size or feed as well afterwards. But after the first season they are left to rough it, being rarely housed and only fed, during the winter, a little hay or straw in the fields, picking up the rest of their food from the remains left from the summer's grass. As may be inferred from this treatment, these animals are very hardy, and at the same time quiet and docile, entirely differing from the vicious, restless little Highlanders, their forefathers. They do not arrive very early at maturity, but at three and three and a half years old will weigh from six to eight hundred pounds, and when older they can be fed up to fourteen hundred without difficulty. The spayed heifers are rather smaller than the bullocks, but they are fit to turn off at an earlier age and their meat is considered more delicate. They are usually spayed when calves, and the operation is no more difficult or dangerous than that of castration. At the Smithfield fat-cattle show, in 1861, a black Galloway cow was shown by Mr. McCombie, of such remarkable merit that some of the critics went so far as to say she should have won the gold medal for the best fat cow of any breed, instead of the short-horn cow to which it was awarded. We copy the remarks of the Mark Lane *Express* about this animal: Here we have unquestionably the best Scot that has put in an appearance for many a year, perhaps the best that was ever seen. Not only is her form so perfect—back, rib, shoulder point, breast end, loin, hip, flank, and rump—but her thigh and twist are wonderful, the rounds of beef full and heavy to the very hocks; her head is beautiful, exactly characteristic of the breed; her coat just what it should be, and she handles like what she is, a magnificent feeder, of a quality worth something to the butcher, and calculated to make the appreciative epicure smack his lips. In proportion to her symmetrical figure elsewhere, her girth forms her weak point; but even this is eight feet nine inches at four years and ten months old. Such commendation as this, among so many superbly fatted animals as are annually collected at the Smithfield show, speaks volumes for the feeding qualities of the Galloway. It is a curious fact that so thoroughly indigenous and acclimated is this breed to their native county, that all crosses of them with improved breeds, have been inferior to the pure race; even the short-horns have failed here to communicate the improvement they have been proverbial for doing in almost all other instances, and the Galloway breeder now wisely confines his attention to the improvement by selection and care of his own native breed. We are inclined to think, from the uncommon hardiness and vigorous constitution of this breed, together with their property of laying the fat on the most valuable parts, and the superior quality of their beef, that there are portions of our country where they would be more profitably bred than some of the larger races of cattle. There are large tracts, of greater or less extent, along the whole range of the Alleghanies, as well as in the northern portions of New York and the New

England States, which might be occupied with advantage by some hardy breed of cattle, adapted to the climate and region, whose product of beef would be remunerative, and whose constitutional vigor would enable them to live and thrive in those localities. We think were the Galloways introduced into such situations they would be found admirably suited to them, and would soon acquire the reputation and value in our markets that their well recognized quality of meat gives them in England.

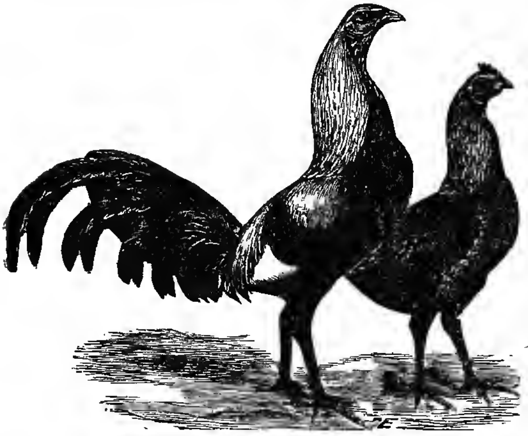
GALLOWS OF A PLOW. A part of the plow head.

GALLS. In farriery, wounds produced by the friction of harness. The little tumors formed under saddles are called warbles. Washing the galled places with a solution of sugar of lead, or keeping them clean with a plaster of common ointment, or dressing with simple cerate, and allowing no further pressure on the part until it is healed, are the proper remedies. Windgalls are little tumors about the heels of horses over-driven, not, however, constituting unsoundness.

GAMA GRASS. *Tripsacum dactyloides* A coarse, perennial, indigenous southern grass, growing to four or five feet. It is very productive, and may be propagated by seeds or roots. The cultivation is scarcely thought advantageous. It is distinct from Grama grass, (*Bouteloua*) a valuable grass of the plains.

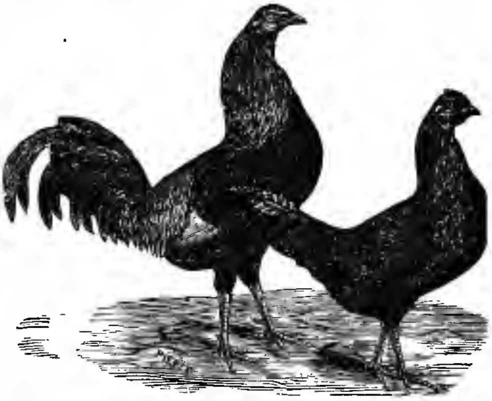
GAMBOGE. The dry juice of the *Stalagmites cambogioides*, and other East Indian trees; a gum resin; poisonous, a drastic purge and emetic.

GAME FOWLS. While it is a fact that the Game Fowl is the most elegant and intelligent of the gallinaceous tribe of barnyard fowls, it is as true that they are not generally liked by farmers, on account of their pugnacious dispositions.



DUCK-WING GAME.

In fact they can not be kept with other breeds, since they at once master and drive every other male bird away. Hence they must be kept separate, this rule will follow with all pure breeds. If to be bred pure, breeds must be kept separate. With game fowls however, males of other breeds will seldom mix with game hens, since the male bird of games never allows an approach of others to his flock. In the United States the same care in breeding games is not generally followed as in England. Since public opinion and law is so strongly against cock fighting that it must be practiced in secret. Yet among those who do breed them pure, as much care and intelligence is bestowed as in England itself. The eggs and flesh of Game fowls are among the most delicate food of any of the gallinaceous tribe, and many fanciers keep them solely for the sake of the flesh and eggs. Their size is medium, the weight of mature birds varying from four to six pounds. The varieties are numerous, and there are many sub-varieties, often having but a local celebrity.



BLACK-BREASTED RED GAME.

So the English, Irish, Malay, Cuban, Mexican, Spanish, all claim special celebrity, while in the South, the Georgian are held to be the most superior, in point of plumage, shape, carriage, hardiness and courage, as they are generally admitted to be superior in the quality of the eggs and flesh. Among fanciers for the pit, the Derby and Duck-wing games are regarded, as among the best of the games. The cut given above shows the Black-breasted Red Game cock and hen. The cocks of this breed, must have the feathers of the head dark red, inclining to orange; the hackle clear orange-red to the very point of the feathers; the back, shoulder and shoulder coverts rich violet-red, the saddle orange-red, and the breast and tail a rich black, perfectly free from white. Red eyes denote pure blood. Lewis describes them as follows: The cock's hackle is striped underneath, but never above; the comb and wattles bright red; the wings are of the same color in the upper part, and rich red chestnut in the lower, with steel blue bar across; breast bluish black, with glossy reflections; thighs the same; tail greenish black, without much down at the roots of the feathers; legs are usually yellow in color. The hen should be of a rich partridge-brown, with red fawn-colored breast; reddish golden hackle with dark stripes. The Duck-wing Game, as illustrated, is another of the breeds of the first class. There are yellow or birchen Duck-wings, but the pure Duck-wings are considered to be the same as the Silver Grays, the blood being acknowledged purer, and it is claimed that they are finer, hardier, and better fighters than the others. Their character is given by Tegetmeier as follows: The cocks, to be correct in color, should have the hackle nearly clear white, with a very slight tinge of straw color, without any decided yellow tinge or dark streak on the feather. The saddle should be as nearly as possible the color of the hackle; the breast a maroon straw; the shoulder coverts a rich brass or copper maroon; the breast and tail pure black. The hens to match these cocks should have their necks of a clear silver, striped with black, the silver to go right up to the comb, but being a little darker above the eyes; the back and shoulder coverts a bluish-gray shaft of feather scarcely showing any difference from the'rest of the feather, any approach to red or pencilling being decidedly objectionable; the breast salmon color, of a nice, rich shade. Salmon Pile Games and Dominique Games, comprise the principal additional varieties of Game Fowls, except those previously mentioned.

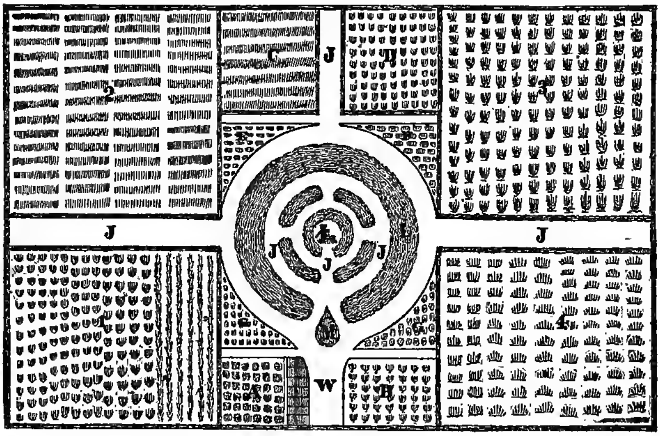
GANGLION. A natural swelling or enlargement on a nerve. A painful tumor formed on the sheath of a tendon.

GANGRENE. Mortification. An ulcer which produces the death of the part; this result is usually the consequence of very feeble health. Nutritious stimulants are to be administered.

GAPE. In ornithology, the opening between the mandibles.

GARDEN. An enclosed place or plat, where plants of any kind are carefully cultivated. Thus we have vegetable garden, fruit garden—generally applied to the cultivation of dwarf trees, berries, and small fruits—herb garden, flower garden, landscape garden—used sometimes to designate places where landscape effects are used in combination with carpet bedding, and dwarf trees, and shrubs. The term now-a-days is used generally as applying to the vegetable garden, and flower garden, although it may be properly applied to all the special uses we have mentioned. (See Gardening)

GARDENER. (See Gardening.)



GARDEN PLAT.

GARDENING. The term gardening is used to designate the cultivation of culinary plants, flowers, and the adornment of the landscape. Thus we have in special branches of these elegant and fascinating branches of agriculture, kitchen gardeners, who raise vegetables solely for private use, or, as in the case of large hotels, where persons are especially employed to grow the vegetables daily prepared for the guests. Market gardeners are those who cultivate tracts of land for the daily markets of cities and villages. A gardener proper, as the term is now-a-days generally understood, is one who raises flowers and vegetables for his own account, or for wealthy citizens, and includes the use of hot-beds, cold frames, green-houses, conservatories, and hot-houses. The landscape gardener deals principally with landscape effects in the building of ornamental walks, drives, roadways, rock work, bridges, lakes, ponds, water courses, and the planting and adornment of the same. The florist, to whom the term gardener may be correctly applied, is one who devotes his time to certain classes of flowering plants, for sale, and also to cut flowers and the making of bouquets and floral designs. Their province is chiefly in the green-house and conservatory, strictly hot-house plants being rarely cultivated by them. The term is also generally applied to those individuals and firms in cities, who make a specialty of selling flowering and other plants, and to the making of bouquets and floral designs. Gardening is as old as history. The Lord God is stated to have planted a garden in Eden. Wherever civilization extends gardening early receives attention, but high art is never attained until wealth and refinement is fairly established. England, France, Germany, Austria, Holland, Belgium, and the United States, have more fine gardens, and higher art in gardening than all the rest of the nations and tribes of the earth together, and in the countries mentioned there is more wealth and refinement than in all the rest of the world. As an aid in laying out a garden and in its economical working, we give an illustration of a garden as laid out by the editor (see cut), and plain practical directions so that no one need err. But the next thing is how to grow them economically, and this can be accomplished in a well-drained soil, deeply tilled, heavily manured, and watered when dry. The drainage we suppose to be good. If not, make it so by thorough draining with tile, laid at least three feet deep. This may cost you sixty or seventy dollars, but it will be money well expended. It is one of the prerequisites in gardening. The deep tillage may be accomplished by the aid of three horses, or, which is better, three mules abreast. Each and every plat of this garden may be manured from the main and circular roadway, and the watering may be accomplished by means of a force pump in the center, and a hose. The hot-bed—that *sine qua non* of every well-arranged garden—is placed near the entrance at the south of the roadway. This will enable you to handle the sash and covers easily, and it will, besides, be near enough to the water so it may be easily accessible for watering. In cropping a garden, the deeper the tilth, the more manure may be applied; and this should always be thoroughly decomposed if possible. If this is the case, one hundred loads may be safely applied, to start with, and thereafter, from thirty to forty loads annually. But some of you may say: It is no easy matter to plow under one hundred loads of manure. It is easy enough, however. Spread, evenly, forty loads over the surface and harrow thoroughly, then, with your deep tiller plow turn this in, a foot deep if you can. Spread forty loads more and plow six or eight inches deep. Then spread twenty loads of the finest manure on top, and in the spring before working the land, harrow it until the tilth is perfect. The other work should have been done in the fall. Upon a soil prepared in this manner you will not suffer from too much, or from a lack of moisture, and your principal waterings will have to be expended upon your rhubarb, asparagus, strawberries, lettuce, radish, celery, and other moisture-loving plants, if you want these extra nice. One reason why a garden should be heavily manured and have plenty of water is, that the excellence of most vegetables consists in their succulence, and this can only be produced by forcing their growth. This, plenty of food, water, and good cultivation will always accomplish. No idle spots must be allowed in the garden. They will become harbors for weeds. No useless fallows—the spaces between the rows are the fallows—no yearly rotation. The land must labor with a rotation each year—thus, early radish, lettuce, turnips, beets, top-onions, carrots, spinach, and other quick-growing vegetables may be succeeded by sorts transplanted from the hot-bed, and also by the late corn, beans, and melons. The only rotation being to succeed fibrous rooted plants, when practicable, with tap-rooted ones, and plants maturing their fruit above ground, with those bearing their fruit below; and plants loving a partial shade should be planted in such portions of the garden as will most easily ensure this. Pains should be taken also, to plant the taller growing vegetables so as to obstruct the view from the walks as little as possible, which may be accomplished, measurably at least, by the exercise of a little skill and forethought. As before stated many practical amateur gardeners object to the use of the plow in the garden at all, and with very good reason especially in a small place, but the use of the plow in preparing the land need not be dispensed with, since the cross-roadways need only be temporary paths, which may be made yearly, while the central portion of the garden is entirely filled up with perennial plants. The principal objection to plowing, heretofore, has been that the spade would more thoroughly pulverize the soil than the plow. But with our present improved forms of plows, the pulverization is fully as complete as the ordinary spadesman will effect, and much better than an unpracticed one would accomplish. Within all the angular and circular surfaces, however, and wherever perennials are planted, nothing but the spade and other hand-implements may be allowed. Where space is an object, but little care need be required with the roadways, except the wagon way. This ought, if possible, to present a hard surface; but if this is not practicable, the surface should be kept rounded, smooth and clean, as should indeed all the paths. This may be accomplished, principally with a good rake, by raking to the middle of the roadway from both sides. The great objection among farmers, to the kitchen garden is the cost. They dislike to spend thirty, forty, or fifty dollars a year upon an acre of land. But if they would reflect for a moment that this outlay will produce from two to five hundred dollars in produce, the surplus of which, or that not needed for consumption in their own families, may be easily sold at good prices in the nearest village or city, if not, indeed, to their more negligent neighbors, the objection must cease; for there is no doubt that the product of an acre of garden, well attended, will supply all the vegetables a large family will need, besides selling enough therefrom to defray all the expenses of its cultivation. Hot beds and forcing houses are warmed either by fermenting manure or by fire heat, but for hot beds manure is the best. Hot beds for winter forcing should be about two and a half feet under ground and one to one and a half feet above ground. This will enable you to use from two and a half to three feet of manure. The principal crop for winter forcing is lettuce, which may be sown about the middle of September, in a cold frame, covering with glass only during cold nights and severe storms. By the first of November it will be ready to prick out at a distance of two and a half inches each way in a hot bed, and from this time it may have a heat of from 50° to 70° Fahr. By the first of December it will be ready to transplant, the last time, at a distance of five inches each way. By taking out alternate rows, we leave one-half. If we now take alternate plants of the remaining rows, we have one quarter left which will be just five inches apart. Those taken out are transplanted in other beds at the same distance apart. By the first to the middle of January your lettuce will have completly filled the frames, when it should be cut, and, after renewing the heat with fresh manure, other lettuce should be planted therein, which has been brought forward for the purpose, as heretofore directed. By this means, after having matured the first crop, you will raise succeeding ones at intervals of about one month, but since some parts of your beds are colder than others, it will not all come on alike, and with a little care, you can cut a regular supply, each day until it will grow in the open air. About January fifteenth to February first, radish may be sown in drills four inches apart, thinning to one-half inch in the row. These will be fit to pull in from thirty to fifty days. About the twentieth of February provision must be made for forcing cabbage, cauliflower, pepper, egg plant, tomato and cucumbers. The first two named must be grown at a low heat like lettuce and radish; the others require a stronger heat say, 60° to 80°. The least frost will kill these latter plants, but if your lettuce, radish, cabbage, and cauliflower are slightly frozen, the bed should be covered up tight and kept dark until the frost is drawn out of them naturally. If light and air are admitted they are ruined, for it must be remembered that plants grown in this artificial manner are more succulent and tender than the same plants grown in the open air. Air must, however, be admitted to growing plants every day when it is not freezing, and care must be taken that the wind does not blow directly on the plant, by tilting the sash against the direction of the wind. The beds are kept from freezing by covering with slough hay, straw, or mats. My practice is to use two thicknesses of straw or reed mats, and about twelve to fifteen inches of prairie hay, varying it for extreme cold or mild weather. By these means I have grown lettuce when the thermometer has sunk as low as 27° below zero. It is sometimes necessary to keep the beds covered for days together, during cold storms. There can be no directions given which will enable a person to force vegetables in winter with entire success. Practice must also come to our aid. What is essential is to keep them warm at the bottom, not to allow them to get chilled at the top, and to give plenty of air when not too cold. Cucumbers, melon, squash, etc., should be sown in pots, or on inverted sods four to six inches square. As soon as cucumbers show signs of running, they should be transplanted, one hill to each sash, and tomatoes, egg plant, pepper, etc., grown in the vacant spaces, pinching the vines from time to time to make them stocky and fruitful, and removing the other plants as they are crowded. Do not, in any event, allow them to become so. Once spindled, they can never after be made stocky and handsome. Tomato and egg plants sown in February, will require to be transplanted three times before the final setting in the open air, at two and a half, five and eight inches apart. Cabbage and cauliflower should be transplanted once at about three inches apart, and if they come on too fast, keep them cool; in fact, hardening plants for the open air—that is, inuring them to the temperature in which they must finally grow—is one of the things that gardeners too much neglect. It is good practice to grow them slowly, and give plenty of air, and bad practice to grow them fast and harden suddenly. Manure for hot beds should be turned two or three times, until fermentation is equal and the color uniform. It should not be streaked with gray, nor fire-fanged. In placing it in the frames, lay it evenly, throwing out hard lumps, patting it from time to time with the fork, to give it some solidity, and find the soft places. Six inches is the proper depth of mold for the generality of plants, except radish, which requires eight inches. The frames above ground require to be banked with horse manure, even with the sash, and if your bed gets too cold the lining should be renewed. The best manure for hot beds that I have ever used is from the city stables, where saw dust is used for bedding, and next, where oat straw is used. The most important plant for forcing, after lettuce, is parsley. It is treated precisely like lettuce, except that when once planted, the heat is kept up by relining, until the plant is exhausted. Another important article, near large cities especially, is mint (*mentha viridis*). The roots are placed in the beds about the middle of February, by strewing, rather thickly, upon five inches of soil and covering two inches deep, adding another inch just as the plants are coming up. In relation to sashes, six feet long by three feet wide, is a suitable size, but the great proportion of my sash are about eighteen inches square, containing six lights of six by eight glass. These are fastened together by means of thin strips, by placing four sash together, making a sash six feet long by eighteen inches wide. Two of these sections, or eight sash, are equal to one of the previous size. After you are all done forcing your plants in the spring, you take the sash apart, and place single ones over boxes to fit, for covering cucumbers, melons and other tender plants. These sash however, will not do for winter forcing, but are admirable for general use. Drainage is so important a matter in connection with gardening that it must not be passed lightly over. If the soil is at all stiff and retentive, it must be underdrained in order to successfully cultivate vegetables; and it is best and cheapest done, all things considered, with tile. We will suppose that your garden land descends regularly to the east, but that in spring, and after heavy rains, it is wet from the percolation of water from above; in this case, if the drains are three feet deep, they may be placed thirty feet apart and should run directly up and down the slope, the grade being uniform to the bottom, that is, not steeper in one place than another. Tile of a caliber of two inches should be laid so that their ends may meet as nicely as possible. Pipe tile are the best, and collars are advantageous though not indispensable. My practice, where collars were not used, has been to spread two or three corn husks over the joints, which do not obstruct the packing of the earth and yet keep out silt which might enter before the earth was firmly impacted about them, besides which they leave scarcely any deposit from decay as does hay and other like material. The best soil for gardening is a deep, rich, warm sand. A good soil is a friable loam and the worst is a stiff clay. Upon the latter, even if well drained, it is useless to attempt to raise early vegetables; one must content himself with the grosser and later crops. Three important considerations with the market gardener are, a warm, rich soil, nearness to market, and ample facilities for getting manure. Without the first he can not raise early crops; without the second, he can not get them to market in good condition, and without the last, he can not cultivate successfully at all. In gardening it is not sufficient that the land was manured last year. It must be manured this year as well, and the best manure is a compost, composed of every waste thing liable to decay about a city, a village or farm. Forty tons per acre each year of such manure will not hurt any land, and we know soils that receive and consume one hundred loads with profit, per acre, to the owner.

GARDEN LAVENDER. (See Lavender.)

GARGET. This is an inflammation of the udder, and may attack the suckling females, of any farm stock, but is principally confined to cows and ewes. It is not common that the entire udder is attacked, the inflammation being confined generally to one or two sections. There will be swelling, heat, pain and redness of the parts; the system will be generally disordered, and there will be loss of appetite, chills followed by fever, and a disordered state of the bowels. There will be loss of milk, it will be thick, lumpy and bloody. The inflamed parts at length suppurate, break down, and in extreme cases there is a total loss of milk, and in any case if the inflammation pass into suppuration, the value of the animal is permanently diminished. In the early stage the persistent application of cold water, or hot water fomentations, will often remove the difficulty. The milk must be drawn often. A syphon is good. When the fomentation is discontinued, the udder should be dried, and thoroughly rubbed with one half ounce of powdered camphor and two ounces, each, of extract of belladonna, and lard oil, the whole thoroughly incorporated together. If the pain is great the udder must be supported with a cloth, with holes for the teats, and to be fastened over the back. If suppuration ensues and abscesses form they must be freely lanced, the abscesses syringed with weak carbolic acid water, and healed by applying an ointment composed of two drachms of chloride of lime to three ounces of lard, thoroughly mixed. If hard swellings remain, reduce them with an ointment of one drachm of iodide of sulphur, and six ounces of glycerine. In every case we ever had ending in suppuration, we have always found it cheaper, in the end, to fatten and sell the cow.

GARGET-ROOT. (See Pigeon Berry.)

GARLIC. *Allim sepa.* The cultivation of the garlic is of great antiquity. The priests of Isis, in ancient Egypt, were forbidden to eat either garlic or onion. The Romans disliked garlic on account of its strong and disagreeable odor. The Greeks cultivated it extensively, and it was used freely by the poorer classes, and the Greeks of this day eat it freely. In Spain, Italy and other countries of southern Europe it is still eaten in a variety of dishes, and it is grown all over central and southern Asia. Its cultivation is exceedingly simple. The cloves are planted in rows six inches apart, by the same distance in the row, and kept free of weeds. When ripe and dry they are tied in bunches or strings and exposed for sale. In the United States garlic is seldom eaten, its use being almost wholly confined to medicine.

GASTRÆUM. In zoology, the whole under surface of an animal.

GASTRIC JUICE. The secretion of the stomach, which, by dissolving fibrin, albumen, caseine, and nutritious matters, has the power of producing chyle, which repairs the waste of the body. It contains pepsin, and is sometimes acid, at others alkaline.

GASTRITIS. This is the name applied to impaction of the third stomach in ruminants, also called stomach staggers and mawhound. It is the distention of the third stomach (*omasum*) with undigested food, and may be followed by congestion, and inflammation of the lining membrane extending even to the fourth stomach. The symptoms are, glaring eyes, madness, staggering, or even prostration by fits, at other times there will be stupidity, and paralysis of the hind quarters. The bowels will first be loose followed by the most obstinate constipation. Blood and water may be passed, with violent straining, and hard lumps may be felt on the belly over the stomach. Give as a sedative two drachms extract of belladonna, and one ounce of bicarbonate of soda, in a pint and a half of water, three or four times a day, allowing it to trickle down slowly, until the urgent symptoms are abated. After that give a quart of linseed oil every day until the bowels are freely moved. The form of Gastritis occasioned in the West, by cattle eating smutty corn in the fields, is attended with sluggishness, stupor and staggering, or by wildness, delirium, and apparent blindness. The following is recommended by Prof. Gamgee, who investigated this disease in behalf of the United States Government. One pound Epsom salts, four drachms powdered aloes, two drachms powdered ginger, and one quart of linseed tea or corn meal gruel, aided by warm injections of a quart or two of lukewarm water every half hour, until the bowels are evacuated. If the bowels do not act freely by the second day, give one half drachm carbonate of ammonia, in a quart of linseed tea, repeated two or three times a day. Upon the return of the appetite, feed succulent food—roots and sweet hay, until the animal is entirely recovered.

GATES. There are few more important conveniences about a farm, and certainly comparatively few farms that are as well supplied as they should be with free swinging gates, that will remain open without sagging. The cause of the sagging is from the settling of the post, or from its being drawn over out of the perpendicular line by the weight of the gate. This obviated, the construction of the gate is merely a question of taste and of the time or money to be expended. To prevent sagging, the posts should be large, set deep on a flat stone, and braced underground in the direction of the strain. The earth must be rammed hard, little by little, around the post. When great strain is expected, as in very heavy, long gates, a trench should be dug from the post at the heel to that at the latch end of the gate, and the two posts connected by scantling mortised into each post, six inches from the bottom, and again six inches from the top. Thus both posts are firmly united, and all sagging is prevented. If a gate is hung exactly perpendicular, it will turn freely in any direction and remain at rest whenever it is stopped. It is extremely difficult, however, to so nicely adjust a gate that it shall always remain exactly true. Hence, various devices have been adopted to prevent sagging or getting out of line. A gate to be self-shutting must be hung with an inclination. If the turning point of the upper hinge is one and a half to two inches nearer the gate than the lower hinges, the gate will fall shut if not opened more than three-quarters of the semi-circle it describes in being fully opened. Thus if the hinges are three feet apart, and two inches out of plumb, a gate twelve feet long will rise at the latch end, eight inches in opening, thus working over ordinary drifts in a snowy country. When the fixtures may be had, all things considered, slide gates are most handy. The swing and slide gate is easy to handle and easy to make, so far as light gates are concerned. Patents were granted in 1862 upon this device, senselessly, if not criminally so, since this idea has been used in the West for forty years or more. The idea is simply to set the posts, upon which the gate slides or turns, diagonally; connect the posts with pins where the top and bottom slat rests; the gate may be pushed back part of the way, and then swung round as desired. Any farmer who is handy with tools, may, by paying attention to the hints given, construct rough gates for the farm. When ornament is desired, any good carpenter should be competent to perform the work.

GEINE. The same as humus, geic acid, ulmin, humic acid. (See Humus.)

GELATIN. That species of animal matter which forms jelly with water when cold. Isinglass, glue, and size are representatives of this body in different states of purity. It abounds in skin, membranes, horns, and bones, but requires long boiling, at a high temperature, for its extraction. A very dilute solution is precipitated by infusion of galls, the product being leather. Gelatin is not capable of itself to sustain life. When moist, it runs into the putrefactive decay, yielding a fetid odor, carbonic acid, water and ammonia. It is a powerful ammoniacal manure in this state, and is best economized in composts. Unboiled bones owe some part of their effects to the decay of their gelatin, which is present to the extent of thirty per cent.

GELDING. A castrated animal. The act of castrating. The most proper seasons are either the early spring months or those of the autumn.

GEMMA. A bud. Hence gemmiparous, bearing buds, or parts capable of development.

GENA. In zoology, the cheek, or part of the face between the eye and mouth.

GENERATION. The production of life has always been a favorite study of scientific minds. All labor, however, to this end, has really added little to our knowledge of the genesis of life. The theory of spontaneous generation has been a favorite dogma with many superior minds, and yet, again, we have no real facts to support the theory. Hence it soon began to lose ground, and is now generally denied by scientific minds. The following condensed arrangements of facts, as stated by the Chemist of the Department of Agriculture of the United States, some years ago, will illustrate how generation may become active, as well as give some means of preventing generation, as in preserving substances necessary to be kept intact. (See also Fermentation and Fungi.) In regard to the origin of yeast cells, for instance, we have to contend with the same conjectures and diversity of opinion as when accounting for the sudden appearance of millions of infusoriæ in stagnant water or in explaining the origin of intestinal worms. It has been stated that the yeast cells already existed in the juice of the living grape, and all other kinds of fruit able to yield fermentable juice, such as apples, pears, blackberries, etc. These minute vesicles, it was said, might readily pass through filtering paper, but it is certain that filtered juice of fresh fruit when examined under the microscope, exhibits no solids, no organized ferment of any kind, but after two of three days apple or pear juice, for instance, will exhibit yeast fungi, and, at the same time begin to ferment. Hence the conclusion is inevitable that we have here to do with a spontaneous cell formation, called *generatio equivoca* or *originaria;* that is, the yeast plant may, without the mediation of a mother plant, originate in a liquid containing, besides water, sugar, dextrine, (gum,) and albuminous matter. The experiments of Schulze, Schwann, Pasteur, Schroeder, and Dusch favor the idea that the germs of the yeast fungi are diffused in the air and water ready to germinate and multiply whenever a favorable opportunity presents itself, like the eggs of the infusoria which have actually been traced in the air, water, mist, and even snow. Profs. Wormley and Sullivant, of Columbus, O., have carefully determined that even with the most powerful microscopes, vision is limited to objects of about one eighty-thousandth of an inch in diameter. Now, some infusoriæ are not more than one twenty-four thousandth of an inch in diameter, and if we suppose that the ova of infusoria and the spores of minute fungi are no more than one-tenth of the linear dimensions of the parent organism, there must be an incalculable amount of germs no larger than one two-hundred-and-forty thousandth or one one-hundred thousandth of an inch in diameter, which may appear in putrescible liquids, in far greater numbers than the germs in atmospheric dust, visible by the aid of the microscope, would lead us to expect. Schwann established the experimental proof that when air is first passed through an ignited tube, before coming in contact with the solutions of sugar, containing besides some nitrogenous substances, no fermentation is excited. The same negative result is witnessed when the air is conducted through an apparatus filled with concentrated sulphuric acid (oil of vitriol) or even a strong solution of caustic potash, (Schulze) or even when filtered through cotton-wool, (Schroeder and Dusch). Dr. F. Mohr makes some recommendations founded upon Schroeder's experiments, among which we will mention that the casks should be closed, after the wine has ceased fermenting, with a bung, through which passes an air-tight glass tube filled with cotton-wool. Thus the air will be sifted of germs as it enters the cask upon the withdrawal of wine by the stop-cock. The fermentation previous to that precaution is best conducted in casks closed by means of a glass tube bent like an inverted letter U, one leg of which is inserted through the perforated bung, while the other dips into water placed in a vessel. By means of this arrangement all the carbonic acid liberated during the fermentation passes out through the water and can easily be watched, while the air is prevented from coming in contact with the liquid in the barrel. A layer of the heavier carbonic-acid gas on the surface of the liquor makes the exclusion still more complete and prevents the gathering of mold (*fleurs du vin*) though the cask be not full. Without such an arrangement it is impossible to prevent the access of air and spores through the invisible openings and fissures in the staves of the casks. On the other hand a slow oxidation seems desirable, to separate nitrogenous matter and to ripen and improve young wines, whilst the development of the bouquet in older wines seems to be promoted by the exclusion of air or oxygen. This gas, in fact, destroys it when brought in free contact with the wine. The germs being destroyed by heat, chemical agencies, or mechanically removed from the air, no yeast fungi are formed. From these facts, Appert's method for preserving different kinds of food may find its explanation. Milk, meat, and vegetables are put into tin cans; these are placed in boiling water and immediately hermetically sealed. Liebig's explanation is that the trace of oxygen in the air that may still be present with the food is at once taken up by some parts of it without giving rise to the formation of ferment at this high temperature; while Schwann believes that by the destructive influence of the heat on the germs of fungi and infusoria, the food is preserved. Though the old theory of spontaneous generation, even when limited to some of the lowest orders of vegetable and animal life, is daily losing ground, and the *omne vivum ex ovo* has become the axiom with naturalists, still there remain yet many unsettled points in connection with this matter, which require further investigation. Thus if we take it for granted that, according to Gay Lussac's experiments, a few bubbles of oxygen gas obtained from chlorate of potassa at a high temperature induce fermentation (when admitted to grape-juice surrounded by an atmosphere of hydrogen or carbonic acid,) it must be admitted that in this case any vegetable germs must have been excluded, provided that those already present in the juice had been destroyed by boiling, and still fermentation took place; and if this be so, were there no yeast plants present? It must also be remarked that in some of the experiments, where the results appeared to favor spontaneous generation a mercurial bath was made use of, to isolate the substances experimented upon. Pasteur has since ascertained that mercury taken from the bath of any laboratory is itself loaded with organic germs. He likewise found that the contact of the atmospheric air with a fermenting liquor is primarily indispensable, only as being a vehicle for the germs of the various ferments. Vegetable organisms frequently collect as mold in saline solutions, and decompose them; also even in dilute sulphuric acid. They have never as yet been observed in solutions of chromic acid and chromates, whence these answer well for preserving brains and other highly albuminous anatomical preparations. A solution of tartaric acid will, even when left in tight glass-stoppered bottles, soon become turbid, and lose its acid taste. A microscopic examination will always trace the cause to a formation of mold which feeds upon the acid. The so-called vinegar plant is a vegetable organism, and acts as a ferment when brought into dilute alcohol Some mineral waters containing free sulphuric acid, and tasting strongly sour, are filled with vegetable mold. Thermal springs of a very high temperature are not exempt from vegetable productions. Even in poisonous liquids containing arsenic, etc., we find some species of fungi which flourish and multiply. Ehrenberg, the distinguished Prussian naturalist, who has devoted the greater part of his life to the study of infusorial life, is opposed to a *generatio equivoca*, and believes that infusoriæ are developed from eggs. He has described about eight hundred living species of these microscopic animals, which swarm almost everywhere. They abound in countless numbers even in the fluids of living and healthy animals. Owing to the extreme lightness of these beings we must not be surprised to learn of their transportation by storms over whole seas and continents. Ehrenberg believes that the baccilariæ found upon some steeples at Berlin came originally from South America. In the Alps there is sometimes found a snow of a blood-red color; it has been ascertained that this coloring matter is composed chiefly of a one-celled plant (*Protococcus nivalis*) of the tribe *algæ;* and, what is most singular, when the snow has been melted for a short time so as to become a little warmer than the freezing point, these beings die because they can not endure so much heat! The effect of antiseptics in arresting fermentation may be differently explained according as we favor Liebig's or Schwann's theory. The former assumes that corrosive sublimate, arsenic, and creosote, uniting with the ferment, prevent the decomposition of it, and, in consequence, that of other organic bodies with which it is in contact. Schwann believes that these substances, acting as poisons, destroy the life of the previously described organisms, and that hence the metamorphosis of vegetable substances is arrested by them. We must acknowledge that, notwithstanding the voluminous writings regarding the origin of many of the lowest forms of animal and vegetable life, it is yet a mystery, and that here fancy has as great scope as ever. The spontaneous change of azotized organic matter called putrefaction is most closely allied to the process of fermentation, being mainly characterized by the evolution of gases of a disagreeable odor, as ammonia, and sulphuretted and phosphoretted hydrogen. For this transposition of elements, moisture, and contact with air, are in the first instance indispensable. It was believed that the animalculæ making their appearance in putrescent substances constituted the primary agent or cause of decomposition; and even if more recent investigations have modified this view, it must be admitted that these minute animals hasten and intensify the resolution of the elements.

GENERATION, EQUIVOCAL or SPONTANEOUS. Being produced without known parents. Originating without apparent seed or germs.

GENESEE OIL. A petroleum found floating on some of the waters of western New York, Ohio, Kentucky, etc.

GENICULATE. Bent at a sharp angle, like the flexed knee.

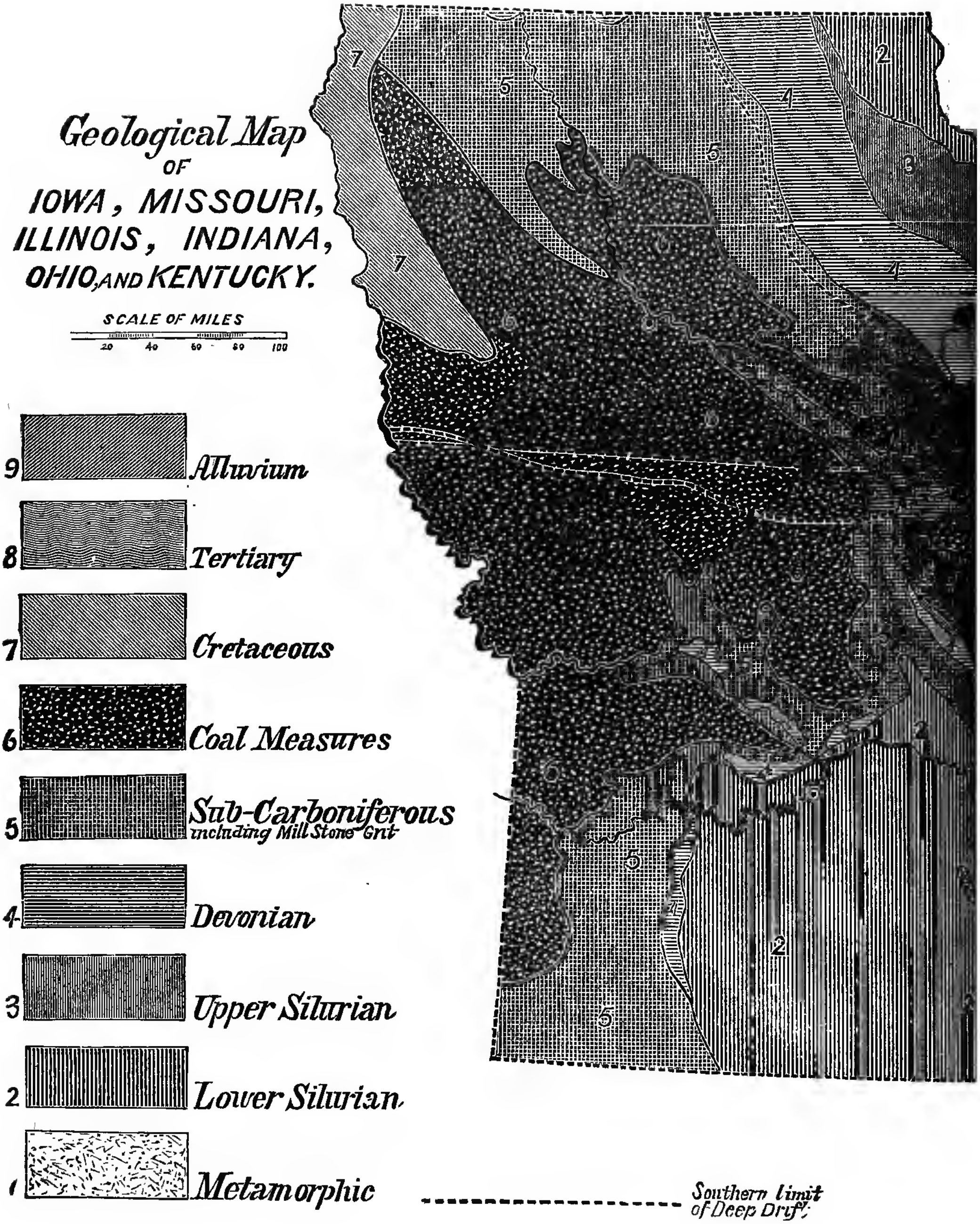
GENTIAN. A genus of highly ornamental plants; the roots of some afford fine bitters, especially the *Gentiana lutea* of Switzerland.

GENUS. Plural *Genera.* In natural history, a distinct but lesser family of plants or animals which are grouped under one general name, and contains distinct species.

GEODES. Mineral masses having a hollow center.

GEODESY. The measurement of the earth's surface.

GEOLOGY. Minerals as an agency in the formation of soils is an interesting study to the farmer. By it he may not only form a definite opinion as to the nature of the soil, by knowing what earths are produced by the decomposition of certain rocks, and the elements of which they were composed, and the study is interesting as showing the various agencies in nature used in the formation of soils, and especially in the formation of western soils. Hon. James Shaw, of Illinois, some years ago, when more actively engaged than now in studies relating to the soil and soil uses, in an address before the Illinois State Horticultural Society, well and accurately elucidated the subject of geology, as relating to the origin and formation of soil, the district of country referred to being rich in various strata, and in its diversity of soil. Speaking of that part of Illinois lying north of the old Silurian beach, which crosses the State from a point near Hampton, north of Rock Island, on the Mississippi river, and passes eastward, a few miles south of Ottawa, bending up a little north of Morris, and passing on to the eastern line of the State, south of Chicago, says: The land north of this Silurian beach was comparatively elevated table land at the time the coal deposits of the great coal basin lying south of this old beach were in process of formation. And there is evidence that over this comparatively elevated table land a great denudation has taken place. Some great force has worn off and swept away, from southern Wisconsin and Northern Illinois, a large amount of material, which has been deposited over the face of the country south and west of that elevated region. It is estimated by Prof. Whitney and other good geological authorities, that at least 300 feet has been denuded and carried away in the region of the Illinois and Wisconsin mounds. These mounds—Scales mound, the Blue mounds, Terrapin ridge, and the various elevated and island-like elevations left over the general level surface of that part of the State north of this old Silurian beach—



Geological Map OF IOWA, MISSOURI, ILLINOIS, INDIANA, OHIO, AND KENTUCKY.

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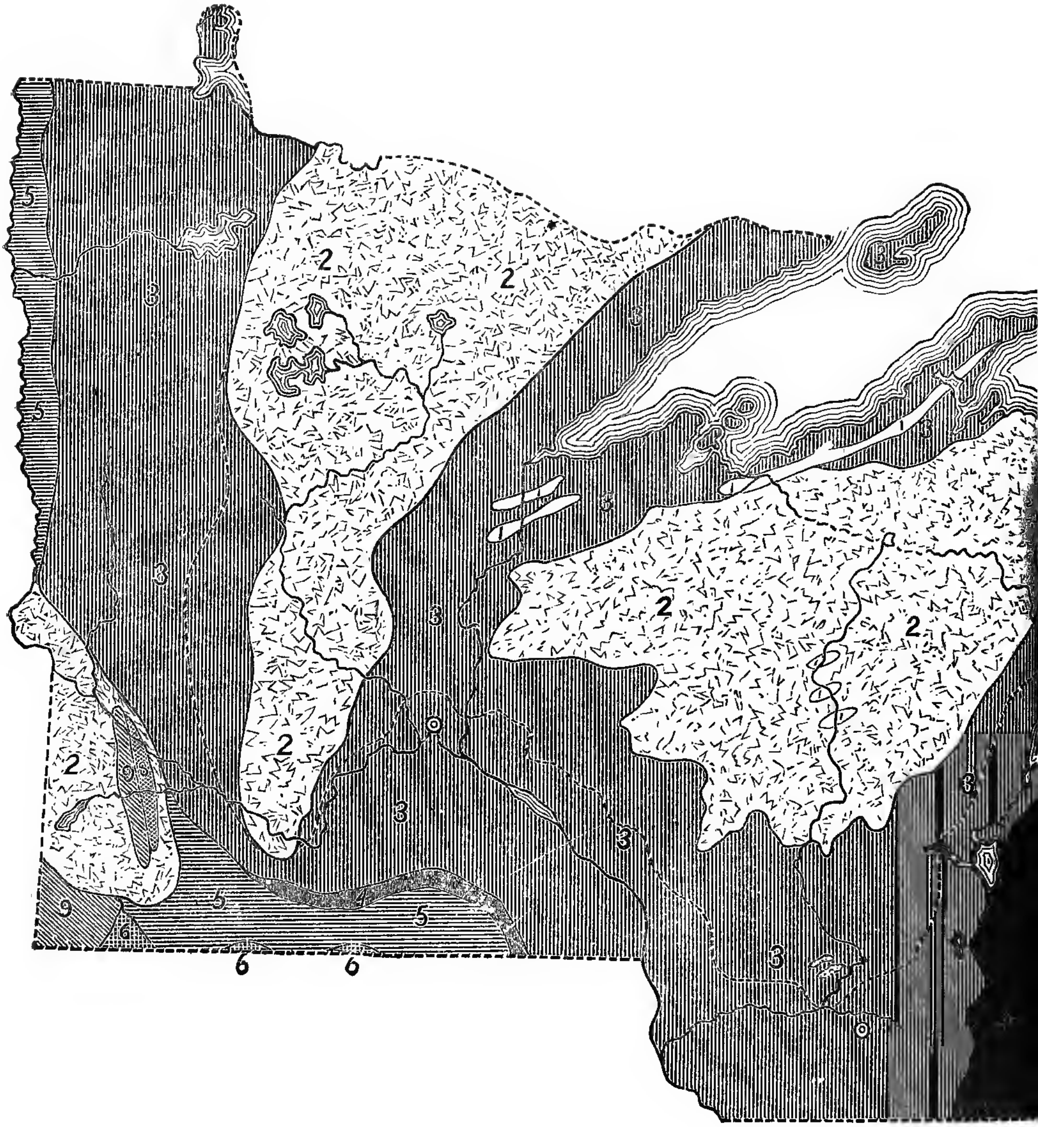
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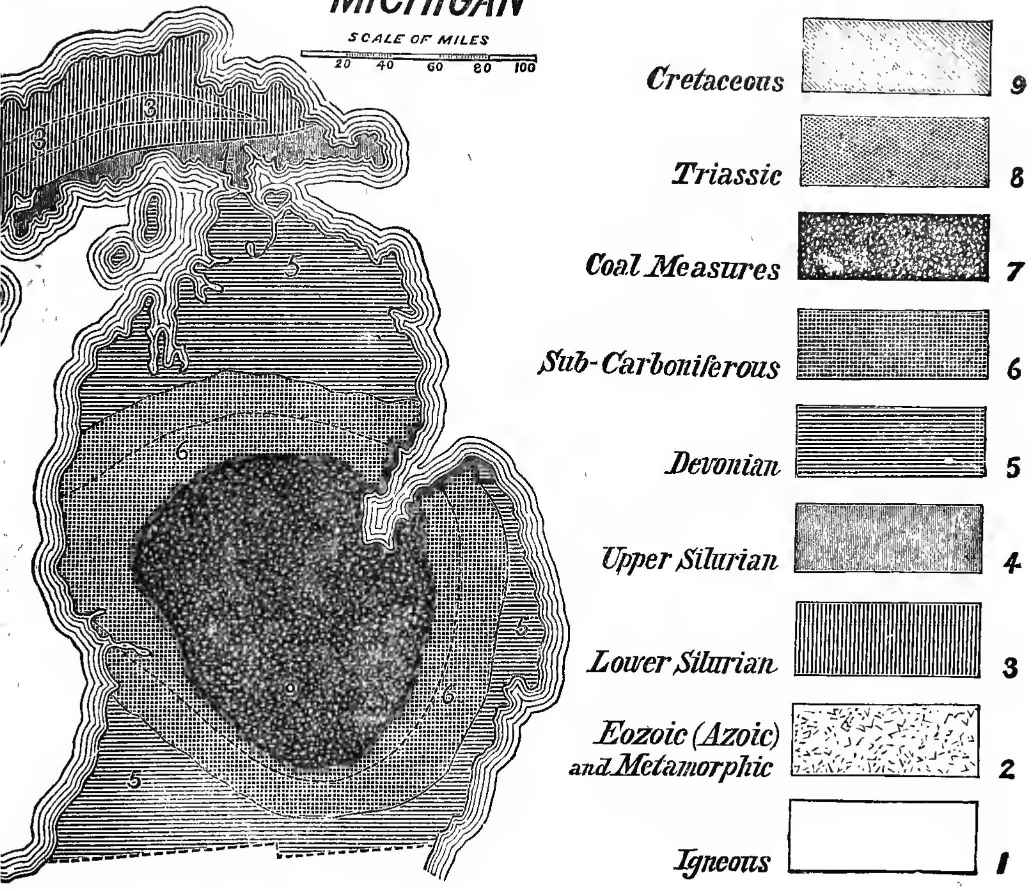
Geological Map
OF
MINNESOTA, WISCONSIN
AND
MICHIGAN



the *Mer de Glace*, or sea of ice. Inasmuch as snow is constantly being added to it, the volume and thickness of this sea of ice would soon become so great as to produce serious consequences if some safety valve was not found to afford vent to the pent up mass. The lower part takes upon itself a slow, almost imperceptible motion, and soon fills the descending valleys with a stream or river of ice. As snow is added at the top, it sinks down to the bottom, and when it becomes ice, is drawn off, as rivers run out of lakes. This ice river flows slow, but is subject to all the laws of flowing water. It widens, it contracts, it deepens where the flow is slowest, and its motion increases where the mass passes over rapids. As it crawls down in its slow, irresistible motion, dirt bands are formed along its margins, stones and great masses of rock roll down upon it, the bottom and sides of the channel are grooved, planed and striated by the mighty power of the grinding, rubbing ice, and all the material accumulated is carried eventually to the lower end of the glacier, and there dumped off in terminal moraines and huge piles of gravel, bowlders, and other drift materials. In the case of the Alps, the glaciers melt when they reach the plain and before they find the sea, and glacier-born torrents begin where the ice ends, and the materials borne thither by the ice are further moved and assorted by the muddy, rushing waters which take their place. The struggle of the snow-flake has ended, and the struggle of the rain-drop now begins. Both are trying to get back to their mother, the sea. It is true the ice river flows infinitely slow, but in comparison with the river of water it moves infinitely strong. The Mississippi, if it were a glacier instead of a water river, could bear upon its back bowlders and whole ledges of stone as readily as it now floats a feather or a saw log. What it lacked in motion, it would make up in the slow, irresistible and mighty force of its all grinding, all consuming procession. Such is a glacier in the Alps, and these glaciers are kneading certain parts of Italy over now as in past time they kneaded North America. Over the new Wrangell's Land and in Greenland the same forces of the ice are in active operation, only to a much greater extent. All upland Greenland is one vast *mer de glace*. But the Greenland glaciers, instead of melting in intermediate sunny valleys, push down into the sea itself, and after crawling along its bottom in the indenting bays and fiords, keep breaking off great masses, which float away in the deep blue waters until they are caught by wind currents and gulf streams, to be borne by them as icebergs and ice floes, whither the drift of the ocean carries them. And thus they float, until warmer seas cause them to melt in sunnier climes, and the floor of the ocean is strewn with their adhering dirt and stones. Certain iceberg paths in the sea already are accumulating at the bottom of the waters fields of bowlders and huge windrows and beds of gravel and dirt. Baffin's Bay, Hudson's Bay, and other northern seas and bays thus become nests of icebergs, and these icebergs before reaching the water, were glaciers, and these glaciers, at their origin, were the arctic snows of Greenland. Thus Greenland, like all other polar and circumpolar lands, is shipping her bowlders and her gravel to the bottom of distant oceans, and these, at some time in the future eternities of God, will become the face of continents. But we will come down to the prairies of Illinois. Starting with the bowlders in the neighborhood of Lake Superior, we trace them south and west to the Missouri river. These crystalline sandstones, flame-colored granites and black-trap rocks, can be traced back to their parent ledges about the starting point. As we advance away from the parent ledges, the bowlders become smaller, and the drift materials towards the Missouri river are only gravels and drift clays. On seeing these curious water-worn stones strewn over the face of the country, the most ordinary mind at once concludes that they did not grow there, but were brought there from some other place. They are nigger heads, lost rocks, wanderers away from where they originally existed. They are entirely unlike any rocks outcropping round them, or in that region, and it is no great task to trace back the track over which they came. The world was lately excited over the Cardiff Giant, but men went to work and soon traced it back thousands of miles to its original bed in the gypsum quarries of Fort Dodge. In the same way they trace the bowlders back towards Lake Superior and Greenland, and could find the origin of each one if a few thousand dollars, or a large humbug, were involved. In some parts of Iowa these loose stones, from the size of a man's fist to that of a shock of wheat, lie so thickly strewn over the ground and accumulate round the margin of the lakes to such an extent, that in the one case parties might walk over them, stepping on the bowlders alone; and in the other, they have given rise to the superstition or belief in walled lakes. In looking over a field of these bowlders once upon a time, my companion, who was somewhat irreverent, exclaimed, that it seemed to him as if the devil, when he sifted the soils down out of his great sifter, had emptied with a jerk the accumulated stones over this particular field. If he had named the Creator, instead of his satanic majesty, I would have thought the comparison a good one. Now, I believe the ice cap which covers Greenland at the present time once extended down into the middle regions of North America. Agassiz, some years ago, demonstrated to the satisfaction of the scientific world, that a great ice cap did cover the drift regions of the American continent. The carboniferous summer slowly ended, and the glacial winter as slowly came on. An entire change of the flora and fauna of these parts of the earth took place. Glaciers covered our land in every favorable locality. Seas of ice accumulated in the basins. Stones were torn away from the outcropping ledges: ledges were ground into sand and clay; motion took place in various directions; but the general movement was towards the south and west. As the climate again grew warmer, the ice cap slowly melted, commencing at the south and melting the ice towards the north. Basins became filled with water, and lakes and seas existed, into which glacial-born currents of muddy water poured, and in which icebergs and floes floated, as wind or currents drove them. And we thus have the compound forces of the glacier, the iceberg, and the water torrent in vigorous operation. These causes, added to and coming after the peaceful agencies and influences, spoken of in the early part of these remarks, explain all that we see, while examining the drift formations, with which our Illinois rocks are covered. The peaceful causes which worked before the drift have also worked since the drift period, and produced some of the later phenomena observable. On pages 392 and 393 will be found a geological map of Iowa, Missouri, Illinois, Indiana, Ohio and Kentucky, and on pages 396 and 397 a geological map of Minnesota, Wisconsin and Michigan, which will present a fair view of the geological formation of an important region of the great Mississippi valley,. comprising as it does the great grain, grass and stock region of the United States. The explanation of the geological terms used are as follows:

Alluvium. Deposits of earth, sand, gravel, and other transported matter, made by rivers, floods, or other causes, upon land not permanently submerged beneath the waters of lakes or seas.

Tertiary. The first period of the mammals, or of the cenozoic era.

Cretaceous. Having the qualities of chalk; abounding in chalk.

Coal Measures. Strata of coal with the attendant rocks.

Subcarboniferous. Carboniferous formation, the series of rocks (including sandstones, shales, limestones, and conglomerates, together with beds of coal), which make up the strata of the carboniferous age or period. The prefix Sub signifying under or below, and includes in the map the millstone grits.

Devonian. Pertaining to certain strata which abound in Devonshire, Eng.; of, or pertaining to their age or formation.

Silurian. A term applied to the earliest of the Palæozoic ages, and also to the strata of the age. The stratigraphical and palæontological break at the top of the Water-lime making two great divisions of the American Silurian, Upper and Lower.

Metamorphic. Pertaining to, or exhibiting, certain changes which minerals or rocks may have undergone since their original deposition.

Triassic. Pertaining, or corresponding to the saliferous beds or new red sandstone of Great Britain.

Eozoic—Azoic. The age preceding the existence of animal life, or anterior to the Silurian.

Igneous. Resulting from the action of fire; as lavas and basalt are igneous rocks. (See also article Soils.)

GERANIUM. Geraniums have come to be as indispensable bedding and decorative plants, as they are beautiful in their variety of rich bloom, in the garden and green house. They are now broken up into so many ornamental varieties, single, semi-double and double, and in the rich variety of coloring of the leaves, or in grateful odor of some of the scented leaved varieties, that there is now a broad field to choose from. Their ease of cultivation, adaptability to many soils—liking best, however, a rich, rather porous loam—has rendered them universal favorites with the masses, either for summer or winter bloom. At the time of frost they may be taken up, heeled in, in boxes, and kept over winter in a light cellar that does not freeze, and the next spring, after all danger of frost is over, set out in the border, to again bloom through the summer. When taken up they should be cut back, fully half the wood,—sometimes more—being cut away. During the winter they should have but little water, only just enough to keep the soil about the roots from becoming completely dry. Those intended for winter blooming, should be taken up about the first of August, cut back to within three or four inches of the earth, carefully potted, and watered until they make new wood, and then be removed to the house before frost. A better way, however, is to strike from cuttings, early in the spring, and by pinching back, induce a stocky growth for winter blooming. The varieties now embrace every variety of shade, from white, through pink, salmon and red, to the deepest purple, and each year brings an endless variety, as candidates for popular favor. In speaking of white geraniums, we may qualify the statement by saying that we have never seen a white that would retain its purity, in the open air in the full glare of the summer sun; but when grown in the conservatory, or in partial shade, they retain their purity of color fairly well.

GERM. The vital part or embryo.

GERMEN. The seed vessel, ovarium.

GERMINATION. The physical changes during the germination of seeds has long been a careful study by students of vegetable physiology. In the germination of seeds heat, moisture, and air are requisite. As each species of plants have their zero at which they are killed, so each has its temperature at which it germinates most kindly. Thus the glacier produces a so-called red snow, from minute species of algæ, which grow at far below the freezing point, and are killed when the temperature is raised to the melting point of snow. To plants flowering in extreme cold succeed vegetation flowering almost as soon as the frost is out of the ground. Next come hardy plants that endure the frosts of our severest winters, and start into life with the first warm days of spring. Half hardy plants follow still later, and tender plants do not begin to grow until all danger of frost is over, to be again cut down with the first frosts of autumn. The pea requires forty to fifty degrees of sun heat for its vegetation; corn, fifty to sixty degrees, and cucumbers sixty to seventy degrees as the lowest heat at which they germinate. The range for plants, hardy and tender, being from about 34° to 140° as the lowest germinating heat, and the highest degree of sun, they will bear. Added to this, moisture at the roots must always be present. Indeed, many plants can not exist in a dry atmosphere at all. Some plants, as many northern ferns, require a moist, cool heat, and also shade, while tropical ferns, as well as many other tropical plants, require not only a high heat, but an atmosphere constantly saturated with moisture, or nearly so. And most of them require a strong heat, hence the necessity of artificial houses for their propagation and care, in the temperate zone. In the article Botany, the germination of the acorn is illustrated. The two lobes of the fruit do not perform the office of leaves as in the bean, but nevertheless serve to nourish the young plant. Above we illustrate, Fig. 1, the growth of the young maple. Here

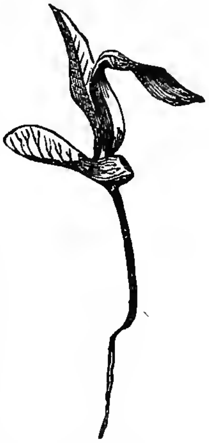


Fig. 1.

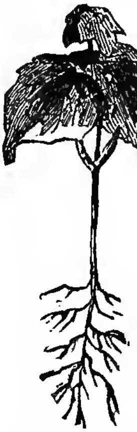


Fig. 2.

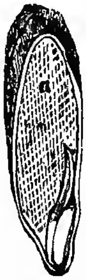


Fig. 3.

the two cotyledons escape from the shell, change color and become the first pair of leaves, of the plant, or seed leaves as they are called. The radicle, in its first growth, sends out the root, which pierces the soil, and the plumule (the bud above the leaves), puts forth true leaves. Fig. 2 shows the process of growth, the young rootlets, feeding from the soil, and the true leaves elaborating the sap furnished. It is now a true and independent plant, which in process of time will, if no disaster happens to it, form one of the monarchs of the forest. Fig. 3 shows the seed of wheat in the process of germination. Here the seed remains in the earth and, by its change and decay, nourishes the plant until its roots can draw nourishment from the soil. The starch of the grain (*a*) is chemically changed to this end as in other seeds, and as in all the grasses, the radicle strikes root, and the spire rises, independently of the seed, above ground to elaborate the juices sent up by the root. Prof. Poey, in an article on Meteorology as Applied to Agriculture, some time since collected a mass of information from the most eminent investigators, at home and abroad. From this we condense the following interesting data in relation to the vital forces of plants: From the highest antiquity innumerable theories have been proposed explaining the vitality which precedes the development of the germ, the reproduction and organization of living beings, animal and vegetable. That action has been successfully attributed to an entity, a principle, an agent, or a force, acting on organic matter exteriorly or interiorly, or in both cases at the same time. Prof. Joseph Henry, deceased, and during his life secretary of the Smithsonian Institution, thought that vitality is a directing principle and not a mechanical power, the expenditure of which does work. This principle, as an engineer, directs the power which is given out when a part of the oxygenized molecules runs down into inorganic matter, namely, carbonic acid and water, etc. By the term running down he means to indicate the passage of molecules from a state of less chemical stability to one of greater, which is the case in the passage of organic matter into inorganic matter. It is well known that organic matter is in a very soluble condition, while carbonic acid and water, into which it passes, possess a high degree of stability. Dr. William B. Carpenter believes that what the germ really supplies is not the force but the directive agency; that rather resembling the control exercised by the superintendent builder who is charged with working out the design of the architect. The vital force which causes the primordial cell of the germ first to multiply itself, and then to develop itself, is directly and immediately supplied by the heat which is constantly operating upon it, and which is transformed into vital force by its passage through the organized fabric that manifests it. Thus heat, acting through the germs, supplies the constructive force or power by which the vegetable fabric is built up. There is evidently in this hypothesis of Dr. Carpenter a double error of idea and of facts. If the germ supplies not the force, but the directive agency, how can the force-heat supply to the germ the constructive force necessary to build up the vegetable fabric, unless the germ in itself could partake of the force of that heat? It would be, in other terms, a force acting on another force, without the latter being influenced by the first force. It is, in one word, an impossibility. As to the question of fact, the production of heat in the germ is, from its origin, at the same time, a cause and an effect, consequently it can not be the primary cause of its development. The decomposition, for example, of the carbon from the grain and its reconstruction in carbonic acid can not take place without a chemical action and a reaction, which, in both circumstances, produces heat. Which is the force that precedes here; is it the chemical, or the calorific action? We could just as well say that the chemical action is the constructive force of germs, and in that case we should come near the running down of Prof. Henry, which is nothing but a purely chemical operation. That which proves the non-identity between the vital force and heat, electricity or magnetism, is the experiments of Dutrochet on the circular movement of the sap in the cellules of the *chara*. He found that heat and electricity act on the circulation of the *chara* in the same manner as other forces called exciting, in diminishing its velocity, causing it to cease altogether, and establishing it anew. But the magnetic force, even when it is prodigious, does not exert any influence. From this, Dutrochet concludes that no relation exists between the vital force which produces the circulation of the chara, and that of heat, electricity, or magnetism. Dr. Joseph Le Conte has published ideas very similar to those of Prof. Henry, with which he was acquainted before the issue of that gentleman's memoir, though he has made no mention of it. He advances the idea that the composition of the carbon of the seed and its combination with the oxygen of the air, to form carbonic acid, sets free a force by which germination is effected, and which suffices to organize the rest. By the formation of carbonic acid, he says, the seed loses weight, and decomposition and loss of weight is absolutely necessary to develop organizing force—the loss of weight being, in fact, the exact measure of that force. If an insoluble food be found capable of conversion into soluble form without loss of carbon, then germination of the seed might take place without loss of weight, by the direct conversion of the heat into vital force. Other authors, as Newport, consider light as the primary source of all vital and instinctive power. Fowler thinks that not only vitality has correlation with all physical forces, but it is the artist of its own cause. Paget advances that every impregnated germ has in itself, and in the properties with which it is endowed, the power to develop itself, according to a law, into the perfection of an appropriate specific form, when the germ is placed in favorable conditions. Of its action, he says, we may specialize it as the germ-power, in consideration of its having its apparent origin and intensest action in the germ. The great doctrine of correlation and equivalency of physical forces, as applied to vital forces, is not yet clearly understood. We must first bear in mind that the laws which preside over vital phenomena, moral or social, differ from the laws of physical and cosmological phenomena only in a higher degree of complexity, always increasing from nutrition to innervation and intelligence. They are only less and less simple, less and less general, and more and more subordinate to the action of a suitable medium. But these three orders of laws, physical, vital, and social, are by no means identical, and there is not even a gradation, nor an insensible transition from one to the other, as Darwin has supposed in his series of animals and vegetables. The elementary properties of matter, according to circumstances, manifest themselves everywhere simultaneously, obeying the universal law formulated by Auguste Comte, of the equivalence between the action and reaction, the manifestation of one exciting the manifestation of the other or of many others of the same kind. This law is already foreshadowed, and it is the one which we study today under the name of the law of the conservation, correlation, and equivalency of forces, or of the mechanical equivalency of heat, etc. Experience shows us to-day that from all the bodies which form the inorganic world there are but four principal ones which enter as integral parts of the weft of living beings, and these are oxygen, hydrogen, carbon, and nitrogen. But the fact that living beings are only formed of cosmical elements leads us to an important view in philosophy, that vital force is immanent to organized matter and inherent to the elements which enter its composition, on the same ground by which gravitation, heat, etc., are inherent. One objects in vain that in the vitality of the germ the physical or chemical elements introduced in organic combination acquire new properties which they did not possess previously, as in the case of sulphuric acid, which shows properties different from those which belong to oxygen and sulphur. This objection would stand good if the new compound, sulphuric acid, should manifest properties different from the chemical one. But it is only a transformation of the elements into another chemical element more complex. The same, the elements susceptible of organization, show but equal vital properties in the transformation into other vital elements more complex and less unstable to form vegetable and animal organisms. Consequently, we can not say, as Dr. Carpenter would do, that heat is transformed into vital force by its passage through the organized fabric. Müller has very well shown that in the germ the force of evolution reaches its highest power; the nearly microscopic impregnated ovale becomes a body considerably larger; when it leaves the bosom of its parent the evolution is much less rapid; it is still less from infancy to puberty; at the adult state evolution arrests itself, and only makes up its own losses, and finally it ceases to compensate these losses; organic degeneration commences, until it becomes an impossibility to be, according to the philosophic expression of Fontenelle. As observes Littré, this evolution can be well represented by the curve of a projectile, whose movement is most rapid at the moment of departure, decreases gradually, and ends by stopping altogether. As the force of projection has space for its domain, and the projectile is aimed at a certain point, the force of life has time for its domain, and the germ is aimed at a certain term of duration. The duration of life is further subjected to the physical laws which govern our projectile; for it is an axiom in physics that movement once begun would last forever if it were not at last destroyed by the resistance it encounters. The vital force or the life also would last indefinitely if it were not destroyed by its resisting medium. This medium is the molecules which are constantly added to and taken from the organism, and which constitute nutrition in the double motion of composition and decomposition, thus offering to us the true definition of life. But this medium being double, that of the cosmological world affects principally our physical organization, and the other in the social world influences principally our moral nature. So the cause of natural death is the resistance of the molecular medium. The source of life is also the source of death. Of the three fundamental activities of matter, nutrition, mobility, and sensibility, a great number of living beings, such as vegetables, do not possess the two last, and still die by natural death. The phenomenon of natural death is then exclusively affixed to the phenomenon of life by the movement of composition and decomposition which constitutes nutrition. It may still be objected that if vitality consists in the immanence of organic matter itself, why does not life spring from all the possible combinations of that matter. It is in this capital question that the immense influence of the medium on the development of the germ is shown by the following solution: An isolated inorganic molecule does not manifest certain essential properties; for example, does not show any electric or magnetic action unless it is placed beside another molecule, under the conditions of influence and reciprocity necessary to those effects. Similarly, in the state of isolation, another molecule will not seem to own any affinity of combination without the required contact, immediately on which the chemical action appears. It is exactly what happens with the isolated organic molecule, which will not develop its vital forces unless it be placed in a convenient medium for this new manifestation. The duality, says Littré, brings in evidence properties immanent to matter, and does not create them. In the supposition of Dr. Carpenter, the germ would have created a new force, at least a new property, by the transformation of the calorific into vital force. The principle of the transformation of forces was not thoroughly well understood by a great number of philosophers, for, strictly speaking, there is no transformation of forces, but a dynamic equivalence of all the various forces of nature. The properties of life are essentially chemical, as they consist in a continuity of composition and decomposition, the same, at the moment when any chemical combination takes place, a change happens analogous to life. The only difference is, that in chemical action the phenomena are instantaneous, and the body becomes again completely inert, while in every organism it renews itself as long as the movement of composition and decomposition lasts. All organized bodies placed in a suitable medium present the double movement which characterizes life, by the increase (nutrition) and decrease of its anatomical elements. So the vital force is not a cause; it is, on the contrary, an effect, a *modus operandi*, an immanence, in one word, the law of organic matter, as universal attraction is an immanence and the law of inorganic matter. The phenomena of vitality are therefore but properties of tissue, which are reproduced afterward in each anatomical element. In fact life seemingly complex, is yet in reality simple.

GESTATION. The gestatory term in quadrupeds is much regarded by their bulk. In the elephant it is about 20 months, in the camel between 11 and 12, in the mare and ass the same. According to the observations of M. Teissier of Paris, in 582 mares, which copulated but once, the shortest period was 287 days, and the longest 419; making the extraordinary difference of 32 days, and of 89 days beyond the usual term of 11 months. The cow usually brings forth in about 9 months, and the sheep in 5. Swine usually farrow between the 120th and 140th day; being liable to variations, influenced apparently by their size and their particular breeds. In the bitch, on the contrary, be she as diminutive as a kitten, or as large as a boarhound, pupping occurs on or about the 63d day. The cat produces either on the 55th or 56th day. The true causes which abridge or prolong more or less the period of gestation in the females of quadrupeds, and of the incubation of birds, are yet unknown to us. Many persons are also unacquainted with the proper age for reproduction, and the duration of the power of reproduction, and other conditions even of the domesticated animals. It can not, therefore, but be interesting to find in the following table the results of observations made on this subject by the best ancient and modern naturalists. The development of the reproductive powers of farm animals differs widely, both as to the age, when they begin to breed, as well as their time of carrying their young. The sow will breed at one year old, the period of gestation being 113 days. The ewe breeds at fifteen months, and carries the young 152 days. The cow will breed at two years old, and if well kept may be put to the bull at fifteen months of age, since she carries young nine months. The mare is usually not bred until the age of four years, but if to be kept as a breeder it is better that she drop her first colt at three years old, and then rest one year, so as to produce the next colt at five years of age, and yearly thereafter; and since the mare goes with young eleven months, care must be taken that she does not go over the first heat before being again served. Most mares will receive the horse on the ninth or tenth day after foaling, and this period should never be allowed to pass over without her being shown the horse. Some of these results do not altogether coincide with the results of observations in England, where, for example, July, the season of copulation for the cow, is considered too late. That period would produce late calves in the following year. November is stated to be the best season for the ewe; for the black-faced ewe it is, but for the Leicester, and, in many situations, for the Cheviot ewe, it is a month too late. The duration of the power of reproduction accords with our experience as respects the mare and stallion; but 13 years of age for the cow, and 8 for the bull, is too young a period for old age in them, fine animals of both sexes, of a valuable breed, having been kept in a useful state to a much greater age. I have seen a short-horn bull in use at 13 years, and a cow of the same breed bearing calves at 18; but if the ages of 8 and 13 respectively refer to the usual time bulls and cows are kept for use, the statement is not far from the truth. From some carefully collected and very extensive notes made by Lord Spencer on the periods of gestation of 764 cows, it resulted that the shortest period of gestation, when a live calf was produced, was 220 days, and the longest 313 days, but he was not able to rear any calf produced at an earlier period than 242 days. From the result of his experiments, it appears that 314 cows calved before the 284th day, and 310 calved

Kinds of Animals.	Proper Age for Reproduction.	Period of the Power of Reproduction.	Number of Females for one Male.	The most Favorable Season for Copulation.	Period of Gestation and Incubation.		
					Shortest Period.	Mean Period.	Longest Period.
		Years.			Days.	Days.	Days.
Mare	4 years	10 to 12		May.	322	347	419
Stallion	5 "	12 to 15	20 to 30				
Cow	3 "	10		July.	240	283	321
Bull	3 "	5	30 to 40				
Ewe	2 "	6		November.	146	154	161
Tup	2 "	7	40 to 50				
Sow	1 "	6		March.	109	115	143
Boar	1 "	6	6 to 10				
She-Goat	2 "	6		November.	150	156	163
He-Goat	2 "	5	20 to 40				
She-Ass	4 "	10 to 12		May.	365	380	391
He-Ass	5 "	12 to 15					
She-Buffalo					281	308	335
Bitch	2 "	8 to 9		February.	55	60	63
Dog	2 "	8 to 9					
She-Cat	1 "	5 to 6			48	50	56
He-Cat	1 "	9 to 10	5 to 6				
Doe-Rabbit	6 months	5 to 6		November.	20	28	35
Buck Rabbit	6 "	5 to 6	30				
Cock	6 "	5 to 6	12 to 15				
Turkey, sitting on the eggs of the Hen					17	24	28
Duck					24	27	30
Turkey					24	26	30
Hen, sitting on the eggs of the Duck					26	30	34
Hen		3 to 5			19	21	24
Duck					28	30	32
Goose					27	30	33
Pigeon					16	18	20

after the 285th; so that the probable period of gestation ought to be considered 284 or 285 days. The experiments of M. Teissier on the gestation of cows, are recorded to have given the following results. 21 calved between the 240th and 270th day, the mean time being 259½ days; 544 calved between the 270th and 299th day, the mean time being 282 days; 10 calved between the 299th and 321st day, the mean time being 303 days. In most cases, therefore, between nine and ten months may be assumed as the usual period; though, with a bull-calf,, the cow has been generally observed to go about 41 weeks, and a few days less with a female. Any calf produced at an earlier period than 260 days must be considered decidedly premature, and any period of gestation exceeding 300 days must also be considered irregular; but in this latter case, the health of the produce is not affected. Mr. C. Hilliard, of Northampton, Eng., states that the period of gestation of a cow is 284 days, or, as it is said, 9 calendar months and 9 days; the ewe, 20 weeks; the sow, 16 weeks; the mare, 11 months. The well-bred cattle of the present time would seem to bring forth twins more frequently than the cattle did fifty years ago, probably the result of better care and feeding. The males of all animals, hares excepted, are larger than the females. Castrated male cattle become larger animals than entire males.

GIBBOSE. Irregular, humped.

GIBBOUS. Protuberant, convex.

GIDDINESS. (See Epilepsy.)

GILL. The quarter of a pint.

GILLS. These organs in fishes answer the purpose of lungs. The plaits under mushrooms of the genus *agaricus* are called gills.

GIN. Distilled spirit, flavored with juniper berries. In machinery, an arrangement for tearing green seed cotton wool from the seeds. It consists of a cylinder closely set with saws, which pass through a grating in an inclined side-hopper, and thus drag off portions of wool, which are conveyed half round the cylinder, and then cleared off by a revolving brush, while the freed seeds slide through to the bottom of the hopper and escape. (See Cotton.) It is also a machine used for raising great weights, driving piles, etc. It usually consists of three long legs or spars, which support a pulley at the top, round which a rope is passed for elevating the weight.

GINGER. *Zingiber officinale.* This plant is a native of Hindostan, but also cultivated in the West Indies, in China and other warm countries. The root is a rhizome, similar to that of the flag; perennial, but the leaves annual.

GINGLYMUS. The hinge joint in animals; as the knee and elbow.

GINSENG. *Aralia quinquefolia.* The root is fleshy, from one to three inches long, and about as thick as a finger, of a yellow color, and somewhat resembling in flavor licorice. The plant is an herbaceous perennial, growing abundantly in the hilly and woody regions of the Northern, Middle and Western States, where it is gathered for shipment.

GIRDER. In architecture, a principal beam in a floor for supporting the binding or other joists, whereby their bearing or length is lessened. Perhaps so called because the ends of the joists are enclosed by it.

GIRDLER TWIG. (See Twig Girdler.)

GIRDLING. (See Wringing)

GIZZARD. A strong muscular stomach in birds, for the purpose of grinding their food with pebbles. It answers the place of teeth.

GLACIERS. Immense masses of ice produced from the snow of mountains occupying the valleys of Switzerland and countries equally elevated. In geology, the study of glaciers is peculiarly interesting; many are ten to fifteen miles long by two broad, and from three hundred to six hundred feet high. (See Geology.)

GLAND. In anatomy, organs such as the liver, spleen, etc., which consist of an immense development of blood vessels, and secrete a peculiar fluid, as bile, urine, etc. They are often microscopic, as the mucous glands of the intestines, and Peyer's glands. Sometimes they receive the specific name of the secretion they produce, as mucuous glands, sebaceous glands, lymphatic glands, etc. In botany, small lumps near leaves, or oval spots on the trunks of trees; they are unimportant except as a means of recognizing species.

GLANDERS. (See Farcy.)

GLASS. That used for conservatories should be of the greatest clearness. The nature of the substance differs with the kind of glass, for flint glass is a mixture of sand, red-lead, and fourteen per cent of potash. Crown, or window glass, contains soda, with sand and lime. The silicate of potash or soda in these cases is very insoluble, and the effect produced can not be considerable unless a large dose is added. Pounded feldspar would form as good a manure. The pounded refuse is also used by glass-makers, and called cullet. The finest powder is used in making sand paper. Glass may be converted into soluble silicate of potash by fusion with its weight of potash or soda in a crucible.

GLAUBER'S SALT. Sulphate of soda. A saline purge used for horses and cattle. The dose is one quarter of a pound or more.

GLAUCOLITE. A mineral, containing four and one-half per cent potash, with silica, alumina, and eleven per cent lime.

GLAUCOMA. A disease of the eye, in which it becomes of a bluish color.

GLAUCOPIS. A genus of passerine birds. Some of the species have wattles at the root of the beak.

GLAUCOUS. Sea-green, like the cabbage-leaf, having a light, bluish tint.

GLEANING. Collecting the refuse of the harvest.

GLEBE. A tract of land belonging to the church.

GLEDITSCHIA. (See Locust.)

GLENOID. The articular cavities of bones.

GLIADINE. A name given by Taddei to the portion of gluten soluble in alcohol. Albumen.

GLIRES. The Linnean name for *Rodentia*, from *glis*, a dormouse.

GLOBULAR. Spherical. *Globose*, resembling a sphere or globe.

GLOBULINE. A rather indefinite term used by botanists to describe spherical particles in plants, whether they be of coloring matter or starch. In physiology, it is the white albuminous substance forming the interior of the blood globules.

GLOMERATE GLAND. Any gland which discharges at once into a duct without having any cavity.

GLOMERULUS. A small capitulum, usually axillary, an old name for an inflorescence. When many branches terminate by little flower heads.

GLOSS ANTHRAX. (See Blain.)

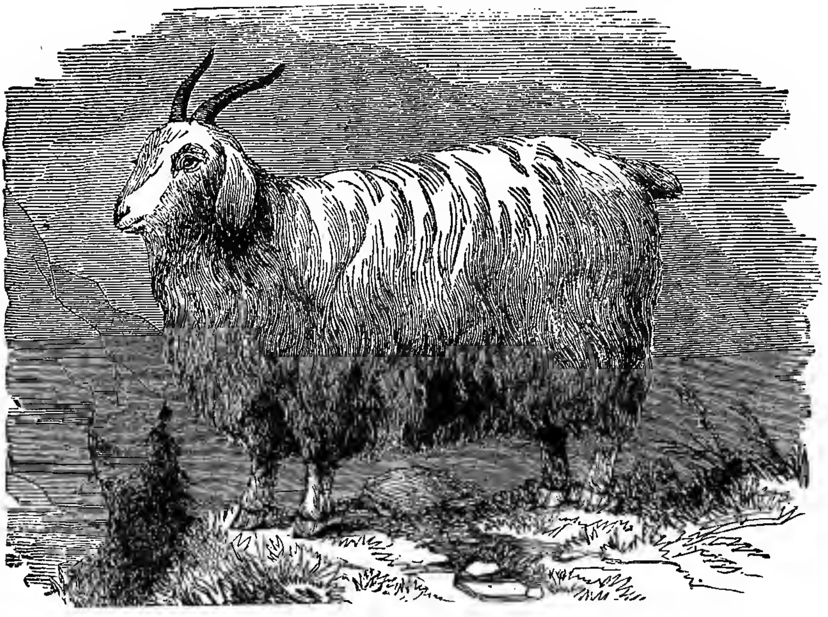
GLOSSO. A prefix to muscles, nerves, etc., attached to the tongue.

GLOTTIS. The upper opening of the windpipe. It is protected with a membrane called the *epiglottis*.

GLUCINUM. The metallic base of *glucina*, a rare earth, existing in the beryl, emerald, and euclase.

GLUCOSE. Grape sugar, starch sugar, sugar of diabetes, of honey. It is difficult to crystallize; exists in fruits, young stems; is readily fermentable; can be procured from starch by the action of dilute sulphuric acid and heat. It differs from cane sugar in containing more water.

GLUE. Lat. *gluten.* Is prepared from the chippings of hides, hoofs, etc. The refuse matter of the glue-makers, according to Mr. Miles, is an excellent manure for turnips.



CASHMERE GOAT.

GLUME. The husk or chaff of wheat and grain plants. The awn is called an *arista. Glumosus*, furnished with glumes.

GLUTÆUS. The name of some of the muscles of the buttocks.

GLUTEN. Lat. The viscid elastic substance which remains when wheat flour is wrapt in a coarse cloth, and washed under a stream of water, so as to carry off the starch and soluble matters. Gluten, when pure, is inodorous, insipid, tenacious, adhesive, and elastic. It is insoluble in water, but soluble in hot alcohol. It is also soluble in a dilute solution of potash. When kept moist and warm, it ferments. Gluten exists in grains, and occasionally in other parts of vegetables; but it is a characteristic ingredient in wheat, giving wheat flour its particular toughness and tenacity, which particularly fits it for the manufacture of bread, and for viscid pastes, such as macaroni and vermicelli. There is generally more gluten in the wheat of warm climates than of cold; hence the excellence of that grown in the south of Europe for the manufactures just mentioned. Gluten seems also to constitute the essential part of yeast. Its uses as a varnish, a ground for paint, etc., pointed out by Cadet, likewise deserve attention. Gluten was discovered in 1742 by Beccaria, an Italian philosopher, to whom we are indebted for the first analysis of wheat flour. The number of plants containing gluten is very considerable. Proust found it in acorns, chestnuts, rice, barley, rye, peas and beans, and in apples and quinces. He found it also in the leaves of the cabbage, cress, hemlock, borage, saffron, etc., and in the sedums; in the berries of the elder, the grape, etc.; in the petals of the rose, etc. Gluten has been shown to resemble albumen so closely that they can hardly be considered as distinct principles. Gluten contains nitrogen, and has, consequently, been called the vegeto-animal principle, on this account. It yields ammonia, when subjected to destructive distillation; and the vegetables which contain it give out a peculiarly disagreeable odor during their putrefaction. M. Magendie, after feeding animals upon different kinds of food, states that gelatine, fibrin, albumen, when taken singly, do not possess the power of nourishing animals for any length of time; they always die. The reverse is the case, however, with gluten, upon which animals thrive well and long.

GLYCERIA FLUITANS. Water fescue, an indigenous grass growing on the margins of lakes and rivers, resembling the water rice.

GLYCERINE. A gelatinous body of a sweet taste. It acts as a base in fats and oils, which are indeed salts of glycerine, stearates, oleates, or margarates, of that body. In soap-making the potash or soda combines with the oily acid, and separates the glycerine.

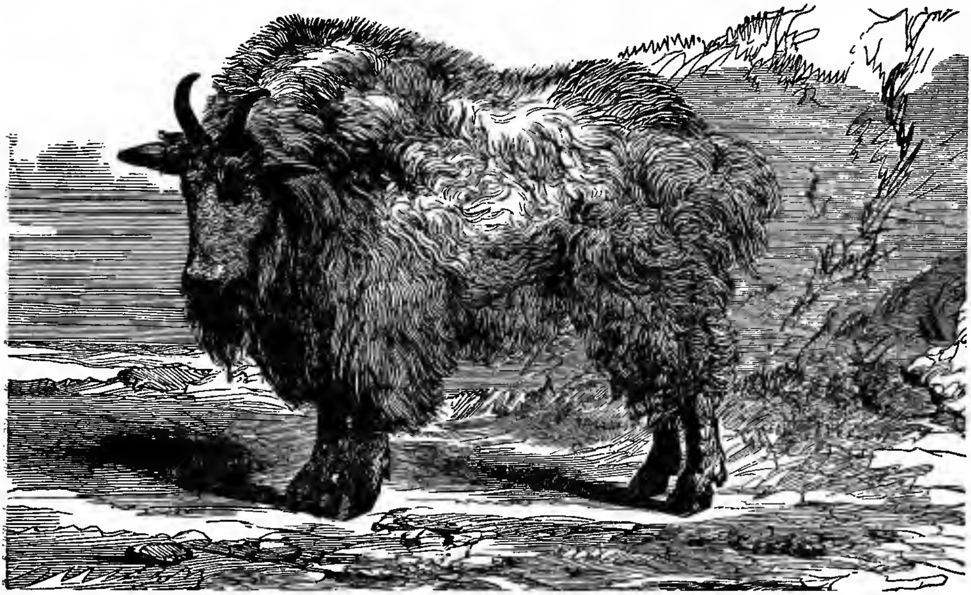
GLYCODEN. This is a term generally applied to animal starch, so-called, discovered by Virchow. He found it in generated liver and spleen; also in diseased kidneys, brain granulations, and concretions of the prostate gland. He says such tissues assume a reddish-brown, or more rarely a dirty brown violet color, where treated with tincture of iodine; when treated with oil of vitriol and iodine in succession, the granulations acquire a green color, changing to a dirty violet or sometimes blue.

GLYCYRRHIZA. The generic name of licorice.

GLYCYRRHIZINE. Glycion. Sugar extracted from licorice and some sweet woods; it has the peculiarity of combining with acids and bases. It is neither crystallizable nor fermentable.

GLYPH. In architecture, a vertical groove.

GNATHIDIA. In ornithology, the lateral parts or rumi of the mandible or lower jaw, which are joined to the cranium behind, and meet in front at a greater or less angle.



ROCKY MOUNTAIN GOAT.

GNATHOTHECA. In ornithology, the horny or cutaneous integument of the beak.

GNATS. Insects of the family *Culicidæ.* Their bites are best treated with lard or olive oil, mixed with a little ammonia.

GNEISS. A stratified primary rock, composed of the same materials as granite, but the mica is somewhat distributed in layers, which give it a striped aspect. The gneiss rocks are remarkably rich in metallic ores.

GNOMON. The inclined rod or style on a sun-dial, the shadow of which marks the time. Their elevation depends upon the latitude. Gnomonics is the art of constructing dials.

GOAT. As a food animal, neither the common goat or its kids are much esteemed in the United States. As for their milk, we seldom see them kept, except occasionally for the use of invalids. In many countries however, as in some mountainous sections of Europe and Asia, it is different. Large flocks are kept, not only for their milk, but especially for the manufacture of cheese. This is especially true of Switzerland. In Mexico and New Mexico large numbers are kept. In some portions of Texas, and in California, they are more or less found. In Alpine regions where subsistence may scarcely be had for cattle, the goat may eventually find a place in the United States. Such, however, has not yet been the case with the exceptions named. Here and there a goat is kept about stables for their supposed (?) good effect on the health of the horses. Of the other varieties of goats introduced into the United States, at different times, there has been great confusion of names. Thus, it has been said, the Cashmere, Persian, Angora, and Circassian goats are the same, only modified by altitude where raised. This is undoubtedly a mistake. The foregoing cut exhibits the Cashmere goat. The Cashmere and Thibet goats are the same, and in their native country are said to yield only about three ounces of the precious down per fleece, of which the costly Cashmere shawls are made. In France the introduction of the Cashmere goat in 1819 did not prove profitable, the yield of down being too small. In 1822 a cross was made between the Cashmere and Angora goat, which brought the yield of down from three ounces to thirty-three ounces per fleece. In 1849 the first introduction of Cashmere goats was made into the South. Other importations into other States have followed, notably to New York and California. They are now found in nearly every State in the Union, principally through their crosses on the common female goat. They are hardy even in Wisconsin, yet they have not proved profitable to their owners, even in mountain districts, and their breeding has pretty much been abandoned, except in some portions of the South, Utah, and California. Above is shown the wild species of the United States, *Aplocerus Montanus*, the illustration being reproduced from a cut of an animal captured in Montana. They are shy, seldom seen and scarcely ever captured alive, but seem well fitted to defend themselves against such carnivorous animals as they may meet in their native haunts, yet it never fights if it be possible to escape by flight.

GOAT'S BREAD. *Tragopogon pratensis* Salsify (*T. porrifolius*) is sometimes so called.

GOLD. Gold coin may always be proved, if any counterfeit be suspected, by its great gravity of 17.157. Pure gold has a specific gravity of 19.3; the reduced weight of the coin is due to the alloy. Aqua Regia is the solvent of gold.

TOULOUSE GOOSE.

GOLDEN ROBIN. (See Oriole.)

GOLDEN ROD. *Solidago virgaurea.* A common weed, found on poor neglected fields. Both the flowers and leaves produce a yellow decoction with water.

GOLD OF PLEASURE. *Camelina sativa.* A cruciferous small annual, bearing pale yellow flowers. It is cultivated like flax, prefers a light soil, and will yield two crops in the year; the seeds yield a sweet oil, and ripens in about ninety days. Called also False Flax.

GOLD THREAD. *Coptis trifolia.* A small evergreen, indigenous to Canada and the Eastern States. It grows in dark, shady, Alpine swamps. The root is tonic.

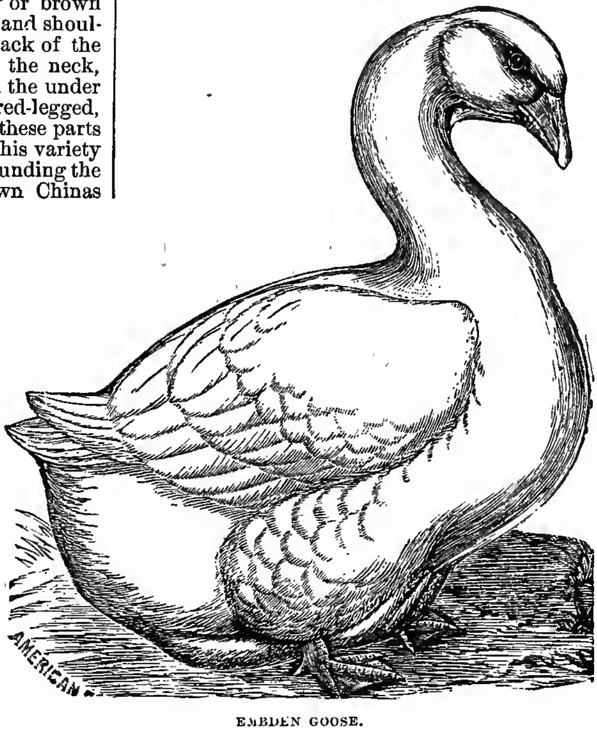
GOMPHOSIS. In anatomy, a juncture of bones similar to that of the teeth in the jaw bone.

GONIOMETER. An instrument to measure the angles of crystals.

GONYS. In ornithology, the inferior margin of the symphysis (union of bones by cartilage, etc.) of the lower jaw.

GOOSE. *Anser.* Of the eight sub-varieties of the goose family supposed to have descended from three distinct wild species, the common gray or white goose, the Bremen or Embden, and the Toulouse, are supposed to have come from the gray-legged goose (*Anser ferus*), still found wild in the north of Europe. The following is a condensed account of some of the principal breeds of geese generally disseminated. The Bremen is a large, pure white goose, with brick-red legs and bill, first brought to this country from Bremen, in Holland. In England they are called Embden, from a town of the same name in Holland, where theirs were first obtained. They are said to be extensively bred in Germany and Prussia, and probably Austria. These geese are very large, weighing from twenty-two to twenty-six pounds, live weight, and occasionally full thirty pounds when in high flesh, as seen at exhibitions, and though so large, they are well proportioned, hardy, healthful, and very showy. They are quiet and peaceable, and take on flesh very rapidly with extra feed. They also supply a superior quality of feathers in very large quantity. The female lays about the same number of eggs as the common goose, but usually commences much earlier in the spring. The Toulouse constitutes the third sub-variety, and was brought to this country from the south of France. It is distinguished from the common gray goose by the uniformity and constancy of its color, which is alike in both sexes, and darker than in the common goose, and by its very large size being as heavy as the best bred Bremen. They are rather short-legged, have round, compact bodies, and a large development of the abdominal pouch, which, in the common goose, is a mark of considerable age, but commences its appearance in this variety when but a few months old. Like the Bremen, they lay early in the spring, are very quiet, fatten readily, and have excellent flesh. Our common geese cross freely with the Bremen and the Toulouse, the first cross yielding birds nearly or quite as large as either parent, but the results of the cross rapidly degenerate by breeding among themselves. To keep up the size, the cross birds should be bred to one of the larger geese. The cross between the Bremen and the Toulouse is even larger than either parent, but deteriorates by breeding-in. The time of incubation of these three varieties is from twenty eight to thirty days. The continents of

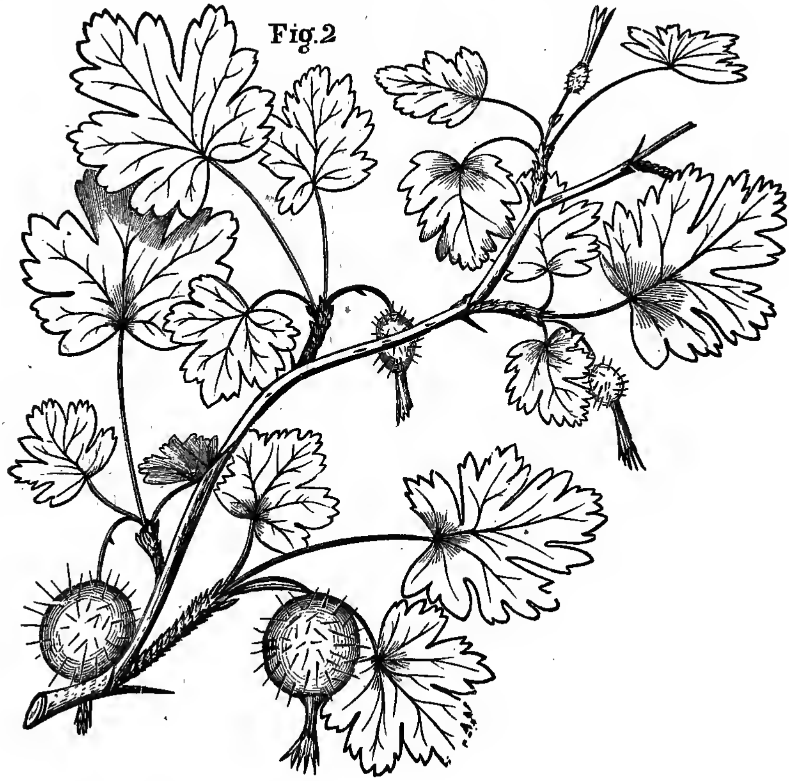
Asia and Africa have furnished us with the next family of geese, consisting of four sub-varieties, three of which are called China geese, while the fourth is known by the name of African or Hong Kong. These are all specifically, if not generically, distinct from those previously described. They are all distinguished by a large knob or excrescence on the top of the bill next the head, that increases with age; beak strong and high ridged; their attitudes graceful and swan-like on the water, but stiff and usually quite erect on land; voices harsh, loud, and frequent; while their wings and tails are short, rendering it difficult for them to fly. Time of incubation, thirty-three to thirty-five days. There is generally great dissimilarity in size, the ganders being much larger than their mates. The three strains denominated Chinese geese are named the red-legged, the black-legged, and the white Chinese goose. The first two have dark gray or brown plumage covering the wings, back, and shoulders, the longitudinal stripe on the back of the neck almost black, while the front of the neck, breast, and flanks are fawn color, and the under and hind parts grayish white. In the red-legged, the bill, knob, and legs are red, while these parts are black in the black-legged, and this variety has usually a narrow white stripe surrounding the feather side of the knob. These brown Chinas are both beautiful little birds, the ganders being about the size of the common kind, while the geese are smaller. The white Chinese goose is considerably larger than the brown kinds, less erect, a long, thin neck, bright orange-colored bill with large projecting knob, and legs but a little darker. It is often called the White Swan goose. All the Chinese geese are excellent layers, producing about twice as many eggs annually as common geese, commencing laying very early in the season. The fourth kind, usually called African or Hong Kong, is colored the same as the brown Chinas, with bill, knob, and legs a dull black, while in size it has no superior. It is also distinguished by a large fold of loose skin under the throat that increases with age, called the dew-lap. The American wild goose (*Anser Canadensis*) is too well known to need a description. It is a distinct species. In a state of domestication the female does not breed until two years old. The gander will mate with the common goose, but their young are mules, and will not breed. Some flocks in the country are so thoroughly domesticated that they do not require to be pinioned, though it is generally safer to remove the first joint when young. There are several purely fancy varieties of geese that are kept to some extent, as the Barnacle goose, the White Canada or Hudson Bay goose, the Brant or Brent goose, the White-fronted or Laughing goose, the Bean goose, and the Egyptian goose. It should be known that geese may be profitably kept on any farm where there is a pond or running stream of water, and plenty of grass range in summer; on this they will pretty much get their living. Where more confined they soon kill the grass by biting close, tramping, and especially from their dung. At night they must have a clean, dry piece of ground upon which to rest, and in winter their quarters must be both dry and warm. The late C. N. Bement, who gave much attention to geese and other farm fowls, wrote upon their management, from which we extract: In selecting a situation for a goose-house or pen, all damp must be avoided; for geese, however much they may like to swim in water, are fond at all times of a clean, dry place to sleep in. It is not good to keep geese with other poultry; for when confined in the poultry-yard they become very quarrelsome, harass and injure the other fowls; therefore it is best to erect low sheds, with nests partitioned off, of suitable size, to accommodate them; and there should never be over eight under one roof; the large ones generally beat the smaller, in which case they should, of course, be separated, one from the other, by partitions extending out some distance from the nests. Nests for hatching should be made of fine straw, of a circular shape, and so arranged that the eggs can not fall out when the goose turns them. From thirteen to fifteen will be as many as a large goose can conveniently cover. The ganders remain near when sitting, and seem to watch them as a kind of sentinel; and woe be to man or beast that dares approach them. They seem very anxious to see the young ones, that are to be born, make their appearance. Incubation lasts from twenty-eight to thirty days, and not two months, as some state, and the goose should have water placed near her, and be well fed as soon as she comes off the nest, that she may not be so long absent as to allow the eggs to cool, which might cause her to abandon her task. After twenty-eight or twenty-nine day's incubation, the goslings begin,



EMBDEN GOOSE.

but frequentry at an interval of from twenty-four to forty-eight hours, to chip the shell. Like turkey chickens, goslings must be taken from under the mother, lest, if feeling the young ones under her, she might perhaps leave the rest of the tardy brood still unhatched. After having separated them from her, they must be kept in a basket, lined with wool and covered with cloth; and when the whole of the eggs are hatched, may be returned to the mother. The male seems to evince the same solicitude for the young as the mother, and will lead and take equal care of them. On the second day after they are hatched they may be let out after the dew is off, if the weather is warm, but care must be taken not to expose them to the scorching rays of the sun, which might kill them. All authors seem to agree on the proper food to be given them. which is coarse barley meal, bruised oats, bran, crumbs of bread soaked in milk or curdled milk, lettuce leaves chopped fined, or crusts of bread boiled in milk. In this country Indian meal moistened with water is generally given; but in our experience we have found it too laxative, and to counteract the effect we have moistened it with boiled milk, and occasionally added chives chopped fine. It is our opinion, however, that more goslings are killed by over-feeding than by starving. A person who is curious in these affairs informed us that he had been most successful when he let the goslings shift for themselves, if the pasture was good. We tried a brood that way and succeeded well. Grass seems to be their natural food, and by following nature in all cases with dumb animals, and more especially with fowls, we have generally succeeded best. After they are three or four weeks old they may be turned out into a field or lane containing water. If their range is extensive they must be looked after, as the goose is apt to drag the goslings until they become cramped or tired, some of them squatting down and remaining at evening, and are seen no more. After the goslings are pretty well feathered they are too large to be brooded under the mother's wings, and will sleep in groups by her side, and must be supplied with good and renewed straw to sit on, which will be converted into excellent manure. Being now able to frequent the pond and range the common at large, the young geese will obtain their own living; and if favorably situated, nothing more need be allowed them excepting the vegetable produce of the garden. We have, however, found it a good practice to feed a moderate quantity of solid food to the young and store geese, by which means they are kept in a growing and fleshy state, and attain a larger size; the young ones are also forward and valuable for breeding stock. Besides, feeding them, especially in the evening, on their return, attaches them to their home. In relation to the diseases of geese, colds and fogs are extremely against geese; therefore, when young, care should be taken not to let them out but in fair weather, when they

Fig. 2

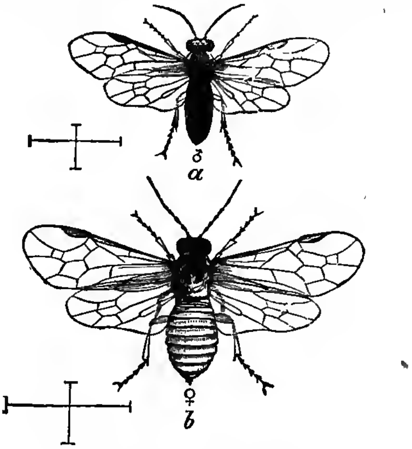


WILD GOOSEBERRY.

can go to their food without a leader. They are particularly subject to two diseases; the first a looseness, or diarrhœa, for which Main recommends hot wine in which the parings of quinces, acorns, or juniper berries are boiled. The second is like a giddiness, which makes them turn round for some time; they then fall down and die, if they are not relieved in time. The remedy recommended by Main is to bleed the bird with a pin or needle, by piercing a rather prominent vein situated under the skin which separates the claws. Another scourge to goslings are little insects which get into their ears and nostrils, which fatigue and exhaust them; they then walk with their wings hanging down, and shaking their heads. The relief proposed is to give them on their return from the fields, some corn at the bottom of a vessel full of clear water; in order to eat it, they are obliged to plunge their heads in the water, which compels the insects to fly and leave their prey. It is the same with the goose, says Main, as with every other bird that is fattened up; that moment must be laid hold of, when they come to a complete plumpness, or they soon get lean and die if they are not killed. Meal and skimmed milk will soon do the business; after ranging in the grain stubbles but little else will be required. These are called green geese, and are most esteemed by the epicure; they will then be about six weeks old, tender and fine. Steamed potatoes, with four quarts of ground buckwheat or oats to the bushel, mashed up with the potatoes, and given warm, it is said, will render geese, cooped in a dark place, fat enough in three weeks. The French method of fattening consists in plucking the feathers from under the belly; in giving them abundance of food and drink, and in cooping them up more closely than is practiced with common fowls; cleanliness and quiet being, above all, indispensable. The best time is in the month of November, or when the cold weather begins to set in. When there are but a few geese to fatten, they are put in a cask, in which holes have been bored, and through which they thrust their heads to get their food; but as this bird is voracious, and as with it hunger is stronger than love of liberty, it is easily fattened, provided they are abundantly supplied with the wherewithal to swallow. The Romans considered the liver of the goose a great dainty, and to increase its size they fed them sixteen days on a paste of Turkey figs, stamped and beaten up with cream; their livers would thus be brought to table, each weighing three or four pounds. Equal parts of the meal of oats, rye and peas, mixed with skimmed milk, form an excellent feeding article for geese and ducks. The grand object of preparing, not geese only, but all kinds of poultry for market in as short a time as possible, is effected solely by paying unremitting attention to their wants; in keeping them thoroughly clean, in supplying them with dry, soft, and green food, water, exercise ground, etc. They should be fed three times a day.

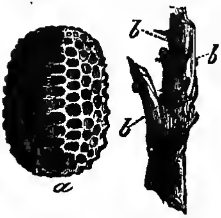
GOOSEBERRY. The original plant of the cultivated Gooseberrry of Europe is said to be *Ribes uva-crispa*. It is found wild quite plentifully, and sometimes side by side with the cultivated varieties, also run wild from gardens. In England many varieties of the cultivated fruit are known, but in the United States but few varieties of the English gooseberry can be grown on account of the tendency of the fruit to mildew. In the West this disposition to mildew is so great that their cultivation is not attempted, except occasionally in the gardens of amateurs, who are sometimes rewarded with a fair crop for their care and pains. On the other hand our small native variety, improved by cultivation and selection from seed, may be grown in every garden, on account of their freedom from mildew. The principal varieties are American seedling Downing's seedling, Houghton's seedling, and Mountain seedling originated from the wild gooseberry of the United States, *Ribes hirtellum*, a cut of which is given. The bushes of our native varieties should be planted four by four feet or, better, five by three and a half feet, for ease in cultivation. All that is required is to keep the plantation free from weeds, the superabundant wood to be cut away each fall. This, with the addition of a dressing of compost each autumn, will ensure uniform crops of fruit. The

GOOSEBERRY SPAN WORM.

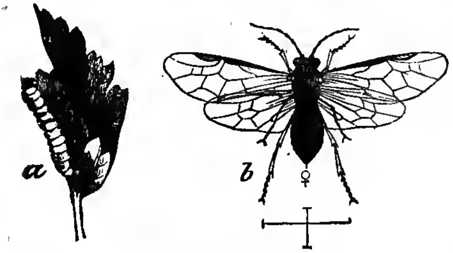


EUROPEAN CURRANT SAW FLY.

cultivation of the European varieties is identical with the last, except, that the soil should have a slight dressing of salt each year. The spaces between the rows and about the plants should also be heavily mulched, since it has been found that mulch is a preventive of mildew. If mildew attacks the fruit, dusting with sulphur when the dew is on is one of the best remedies. The insects attacking the gooseberry feed also on the currant. In the article Currant Worm, we have given some of these. The principal species not given there are as follows: The Gooseberry Span worm, more generally called the Currant Span worm (see cut); *a*, *b*, larvæ, *c*, pupa, should not be confounded with the Saw fly given below. The perfect insect is a small moth, while the Saw fly is a two-winged fly. The Span worm, spins down when disturbed, and either of the species should be carefully hand picked. The egg, enlarged at *a*, and natural size at *b*, is also shown. The Span worm appears with the first leaves, while the Saw fly comes in May and June. On page 409 are cuts of European Saw fly, *a*, male, *b*, female; the cross lines showing natural size. Below is given cut of the Native Saw fly and larva. The larva of the European species is much larger. The larvæ of the native species, according to the late Dr. Walsh, are grass green worms, half an inch long with black heads, the heads becoming green after the last molt, but with a lateral brown stripe meeting with the opposite one on top of the head, where it is more or less confluent. They spin their cocoons on the bushes on which they feed, and the fly appearing about two or three weeks after, or about the middle of August in the North. The larva of the imported Saw fly is larger, distinctly spined, and covered with minute warts, which the native worm does not have. Many persons use Paris Green and London Purple for dusting both currant and gooseberry bushes to kill the worms. It should never be allowed on plants bearing fruit above ground after the fruit is set. White hellebore powder, however, is innocent to human life, and an effectual insecticide.



EGG OF GOOSEBERRY SPAN WORM.



NATIVE SAW FLY.

GOOSEBERRY MIDGE. (See Midge.)

GOOSEBERRY WINE. (See Gallizing.)

GOOSEBERRY WORM. (See Currant Worm and Gooseberry.)

GOOSEFOOT. The goosefoot family (*chenopodium*) is named from its more or less cleft leaves, somewhat resembling a goose's foot. The more common and best known is the pig weed or lamb's quarter (*C. album*) sometimes used as greens. Another variety is the maple-leaved goose foot (*C. hybridum*) a common weed with a heavy odor of stramonium. A southern variety, the so-called Mexican tea (*C. ambrosioides*), and, as stated by Gray, the variety (*C. anthelminticum*), the latter known as wormseed, are both well known as vermifuges. The varieties of this genus are all comparatively worthless, and should be eradicated wherever found.

GOOSE GRASS. Several species of *Galium* are so-called from being eaten by geese.

GOPHER. The striped and spotted squirrel found all over the West is incorrectly called Gopher. The gray squirrel of the prairies is also sometimes confounded with this species. The two-pouched gopher (*Gemys bursarius*) is entirely distinct, and, where it abounds, so destructive as to call forth the most persistent efforts from the farmer in its destruction. The true gopher is found in some parts of Indiana, Michigan and Wisconsin. South and east of the Illinois river it is abundant, but between the Illinois river and the Mississippi it is comparatively rare. In Missouri, Iowa, parts of Kansas, Nebraska and in Minnesota it is common. So, also, it is found in the valley of the Red river of the North up to Pembina. Its true habitat is on the prairie, where there are abundance of roots upon which it can feed. The late Robert Kennicott describes their manner of excavating burrows as follows: On the wild prairie the gopher throws up a mound of earth of considerable size, frequently ten feet in diameter and from one and a half to two feet in height, being highest in the low ground liable to inundation. In this mound is his nest, in which the young are bred, and from it endless galleries are excavated in various directions, a foot or two below the surface. These are complicated, frequently intersecting and running together, and, in short, forming a complete network of underground roads through which these strange animals can travel for miles. In digging them the gophers run up shafts at irregular intervals from two to ten feet apart, which open to the surface usually a little at one side of the main gallery, and from each of these side cuts they throw out the earth brought from the main gallery below, to the amount of from a quart to one or more bushels, and thus form little piles of earth by which the general course of the burrow may be traced. They have a remarkable antipathy to the light, and these side cuts are usually closed again with earth after they have served their first purpose; and, if a hole be opened into any part of the burrow, it is closed as soon as observed by the inmates. Only a portion of the earth taken by the gopher from his main highway is carried to the surface, much of it being used in filling the side cuts, into which it is packed, sometimes even more closely than the surrounding soil, and in digging about their burrows I have thus been able to trace these cuts. The galleries are also apparently enlarged by pressing aside the earth. These are of greater dimensions than would seem necessary for the accommodation of an animal of this size. The main galleries are about four inches in diameter, and the side cuts from two to three inches. I am informed that, in digging wells, shafts have been found sunk by gophers to a depth of ten or twelve feet, with water at the bottom. The opinion of those who have observed such holes usually is, that they are dug so as to procure water. The proper food of the gopher consists of roots, which are usually obtained without leaving his underground roads. Though he sometimes comes to the surface to feed upon the leaves and seeds of plants, this does not appear to be his principal means of subsistence. The manner in which he naturally procures food is by approaching it from below, without coming above ground at all. He lays up stores, apparently at all seasons. Considerable quantities of the roots of the rosin-weed (*Silphium laciniatum*), wild artichoke, or wild sunflower (*Helianthus*), spike flower (*Liatris*), and various other plants, are collected in its burrows on the prairies; while, in cultivated fields, the roots of the grasses, potatoes, and other vegetables, are found in its holes. Wherever they exist on cultivated land, the gophers are very injurious. No animal is more complained of by our prairie farmers. Scarcely a crop escapes their ravages. They desert the wild prairie to inhabit cultivated hay-fields; and they particularly delight in clover and timothy meadows. Here they not only do mischief by devouring the roots of the plants, but impede the mowing and raking of the hay, by inequalities of surface caused by their mounds. Grain fields are much injured by them while the plants are growing; and, when the stacks are left standing after harvest, the gophers burrow from below, and frequently cut up and drag into their holes, or otherwise completely destroy, entire sheaves. All root-crops suffer severely from them. In passing below the surface, they gnaw off the bottom of carrots, beets, turnips, and other tap-rooted vegetables, without disturbing the tops or coming above ground. In fields of common and sweet potatoes, they work under the hills and remove the tubers, and thus sometimes destroy half or more of the crop before the dying vines give evidence of the mischief. Instances are related in which potato heaps, covered with earth and left out during winter, have been entered by the gophers and the tubers carried off. They sometimes enter melons, pumpkins, and squashes, through holes at the bottom, and eat out all the fleshy part, and then fill the hollow rind with earth, leaving it in a condition to create much astonishment when harvested. They also feed upon the bark of the roots of trees, as well as upon the fleshy roots of herbaceous plants. Some farmers are greatly injured by their destruction of Osage Orange hedges. No small item of their injury is the gnawing and cutting off the roots of fruit-trees. A considerable portion of all the trees have been killed annually in some young orchards in Iowa and Illinois; and several fruit-growers inform me that thay have seen as many as a dozen large bearing apple-trees killed by them in a single orchard. Forest trees, six or eight inches in diameter, have died in consequence of their roots being cut. Trapping is the most successful mode adopted for capturing this animal. A hole being opened into a gallery known to be traveled by him, a small steel trap, covered slightly with loose earth, is placed in the track, in such a position that, when he comes to shut out the unwelcome light, he must unavoidably be caught. It is not necessary to bait a trap thus used. The gopher can very readily be poisoned by strychnine or arsenic in pieces of vegetables placed in their burrows, as is sometimes practiced with the California species. There could be no danger attending this, and the probability is that the method would be highly successful. In Georgia and Florida, another species of this genus (*Gemys pinetis*) is found, where it is known under the name of Salamander, whereas a terrapin, or fresh-water turtle, is called gopher. The pouched rat of Arkansas is also called Salamander. The name gopher is derived from the appellation of *gauffre*, given these animals by the Canadian voyageurs. It is stated that, on the Upper Missouri, they are sometimes called mulos. Twelve species of gophers inhabiting the United States are described in Baird's General Report on Mammals in the Pacific Railway Survey. Of these, only the present species and that of Florida are found east of the Mississippi. The Californian species (*Gemys bulbivorus*) is even more destructive than the eastern gopher.

GOSSYPIUM. The generic name of the cotton plant.

GOULARD'S EXTRACT. A concentrated solution of sugar of lead in water; it is used, diluted, as an application to galls and external inflammations.

GOURD. *Cucurbita lagenaria.* Calabash. Annuals readily cultivated, requiring a deep soil. Many varieties exist. The pulp is purgative in most varieties.

GOVERNOR. In machinery, an arrangement for regulating the speed of machines.

GRACILE, GRACILIS. Slender.

GRACKLE. The purple or crow blackbird. It has the reputation of being one of the greatest pests of the Western farmer. In regions where they flock, after nesting time, they undoubtedly do extensive mischief to the ripening grain, especially to oats, and later to corn. The remedy, however, is not difficult: Three or four days persistent shooting, especially early in the morning when they are flocking out, and at evening as they are returning to their roosts, will send them to other feeding grounds. At all other seasons of the year they are indefatigable hunters of the seeds of weeds, and in the breeding season, of insects. It is still an open question among farmers whether they do more injury than benefit. It is more than probable that to the farmer they are of more benefit than injury. The red-winged black bird is far more destructive to grain, and the Grackle is often confounded with this bird when young, their size and plumage then being similar to the ordinary observer. The red-winged species is quite destructive in new settlements, sometimes so much so, during the ripening of small grain, and later, of corn, that organized efforts must be made by shooting or otherwise driving them away, in order to save the crops. The generic name of the Boat-tailed Blackbird of the Southern States is *Quiscalus major*, found near the sea coast, on the streams: *Q. versicolor* is the Purple Grackle or Crow Blackbird of the North, and *Q. ferruginus*, is the Rusty Blackbird of the North; both of the latter migrating to the South in the winter.

GRACULA. The genus of jay birds. They are insectivorous.

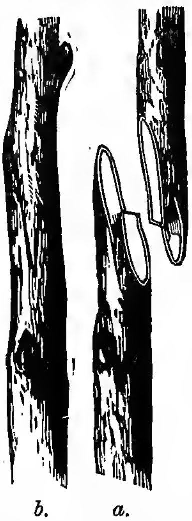
GRADATORY. A term applied to those animals which have legs nearly of the same length, so that they can walk on the four. Birds which have the lower portion of their legs covered with feathers.

GRADE CATTLE. Grade cattle may be defined as the descendents of any pure breed crossed upon the native or mixed breeds of a country. In the mixed farming of the older settled States the three purposes of beef, milk, and working cattle are desired. Hence the grades are made up of Short-horn or Hereford blood for beef, of Devon or Hereford for working cattle, and of Dutch, Ayrshire, or Jersey, bred with the native cattle of the region, according as beef, labor, or milk is desired. In the vicinity of large cities, where large quantities of fresh milk is consumed, the Ayrshire and Holstein (Dutch) cattle are much used, while, when quality and not quantity of milk is especially desired, the Jerseys are the favorites. The adaptation of grades to the wants of the community, therefore, determines the breed to be used. In New England, New York, Pennsylvania, and northern Ohio, Illinois, Wisconsin, and Iowa, and other dairying sections the milk breeds predominate, the old style Short-horns forming the basis of the stock worked upon. In all the more settled grazing regions of the country the Short-horns predominate, though of late years, from their fine constitutions, early maturity, and superior beef, the Herefords have successfully competed, and, since 1876, large numbers of Short-horn and Hereford bulls have been shipped to the immense grazing grounds east of the Rocky Mountains and the great valleys interlaced within the Rocky Mountains, for the purpose of breeding grades for the eastern and European markets. Grade Short-horns and Herefords have been fed to a weight of 3,500 pounds, live weight, and at the stock yards at Chicago it is not unusual to find many that will average from 1,800 to 2,000 pounds.

GRADIENTS. On railways, the ascending planes.

GRADUATED. Marked into regular divisions; increasing in equal measures, as a scale for weighing quantities.

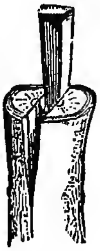
GRAFTING. Grafting is the uniting of a shoot or scion containing one or more buds to a stock or root with a view, by their union, to produce a superior fruit upon the inferior stalk. There are a number of ways of grafting, cleft grafting being the mode usually adopted. This is simply splitting a stock, first sawed off square, and inserting on each side a scion tapered down to a thin, wedge-shape, with a sharp knife, so the inner bark of the scion and stock will just meet. To insure this meeting at some point the top of the graft is sometimes carried in slightly. The whole is then covered with grafting wax to exclude moisture and air, and the grafts usually take kindly, if the grafting be done at the right season of the year, that is in the spring before the leaves appear. Root grafting is performed in precisely the same manner as stock grafting pieces of root being used as the stock. This may be done late in winter, the roots having been carefully saved in moist earth in a cool cellar for this purpose. The grafts may be cut any time in mild weather in winter, tied in small bundles, and kept in moist sand until wanted. The only tools for grafting, on the farm, is a sharp, panel saw, a keen pocket knife, for paring the stocks and sharpening the grafts, a butcher knife, and a mallet for splitting the stocks, and grafting wax for spreading over the mutilated parts. Saddle grafting is used only with stocks of a size corresponding nearly with that of the grafts. The accompanying cuts will show this manner of grafting; *a* being stock and graft pared to fit each other, b showing the same united. Sometimes the stock is simply pared to a thin wedge and the scion simply split and wedged on, but this is a very crude and shiftless way of operating. In either of the operations of grafting described the whole exposed surface should be well waxed with grafting wax, to keep out water. Another common mode of grafting is by approach, or in arching, as it is termed. A modification of this is practiced where the bark of a valuable tree has been injured or gnawed by mice. The injury is pared smooth at the edges of the bark down to the live wood, and a piece of healthy bark fitted accurately thereto, and covered with grafting wax until it is healed; or scions set close together and brought fresh bark to fresh bark at top and bottom, and securely fastened. Dr. Warder, in American Pomology, in relation to grafting old orchards, and upon root grafting, writes: Old orchards of inferior fruit may be entirely re-made and re-formed by grafting the limbs with such varieties as we may desire. A new life is by this process often infused into the trees, which is due to the very severe pruning which the trees then receive; they are consequently soon covered with a vigorous growth of young healthy wood, which replaces the decrepid and often decaying spray that accumulates in an old orchard, and the fruit produced for several years by the new growth is not only more valuable in kind, according to the judgment used in the selection of grafts, but it is more fair, smooth and healthy, and of better size than that which was previously furnished by the trees. Certain varieties are brought at once into bearing when thus top-grafted, which would have been long in developing their fruitful condition if planted as nursery trees. Others are always better and finer when so worked, than on young trees. In renewing an old orchard by grafting its head, it will not be a good plan to attempt the whole tree at once; the pruning would be too severe, and would be followed by a profusion of succulent shoots breaking out from the large branches, such as are called water-sprouts. Those who have practiced most, prefer at first, to remove about one-third of the limbs for grafting, and those should be selected at the top of the tree. The new growth thus has an open field for its development, and the lower limbs will be invigorated, while they tend also to preserve the equilibrium of the tree in a double sense, physically and physiologically. The next year another third of the limbs may be grafted, and the remainder the year following, as practiced by Mr. Geo. Olmstead, of Connecticut, who, on the sixth year from the first grafting, harvested

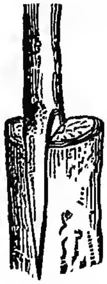


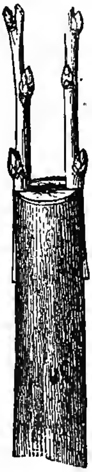
twenty-eight and one-half bushels of choice apples from a single tree that was seventy-five years old, and which before only produced inferior fruit. J. J. Thomas recommends to give a well-shaped head to such newly formed trees, and to prevent the branches from shooting upward in a close body near the center of the tree, that the old horizontal boughs should be allowed to extend to a distance in each direction, while the upright ones should be lopped. The same writer also advises, instead of cutting off large branches and grafting them at once, it is better to prune the top in part which will cause an emission of vigorous shoots. These are then either budded, or grafted. And as the grafts gradually extend by growth, the remainder of the top may, by successive excisions, be removed. The illustrations we give will show the series of operations in grafting in its various stages: *a* is a stick of buds ready for working; *b*, section of graft pared; *c*, stock cleft and wedged open with wooden wedge; *d*, same, with graft inserted; *e*, stock with graft set on each side; *f*, cross section of stock and graft showing exact meeting of inner bark, a most essential qualification.

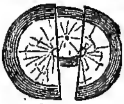
a.

b.


c.


d.


e.


f.

Grafting in the nursery is, or should be, either done at or near the collar of the stock, or it is performed in-doors upon the roots or sections of roots of young stocks. The latter may be first described, as it constitutes the most extensive means of multiplying fruit trees. It is a sort of machinery, with division of labor, and appliances, that enable the operators to turn out immense numbers. Machinery has indeed been applied to the business; we have grafting apparatus to facilitate the work. The Minkler machine consists of a frame or gauge which regulates the angle of the slope, which is cut with a broad chisel that reduces the roots and scions to a condition for putting them together; by its use an immense number of grafts can be cut, and another hand binds them together with the waxed thread, without any tie. Mr. Robey's machine consists of a complicated shears to cut the slope and tongue at one operation, preparing the pieces for whip grafting. Mr. S. S. Jackson, of Cincinnati, has also invented an apparatus for this purpose, which proves to be very useful. In root grafting the methods of performing the operation vary somewhat, but all agree in the object to be attained: the co-aptation of the scion with a piece of root. Some grafters use only the upper portion of the root, thinking the original collar of the seedling stock the only point at which the most perfect and successful union between the aërial and terrestrial portions of trees should or can be effected —theoretically this may be very well, but the practice constantly pursued, in myriads of cases, abundantly proves that the grafting need not be restricted to this part, and that a perfect union may be effected at any point of the root, and that this may even be inverted. The common practice has been to take two or more cuts from the root, when of sufficient size and length. For root grafting, thrifty stocks are wanted of one or two years' growth, the smoother and straighter the roots, the better. These should be taken up from the seed-bed in the fall, selected, tied in bundles, and stored in the cellar or cave, or buried in the soil where they shall be accessible at any time, and where they will be kept fresh and plump. The roots and scions having been prepared and under shelter, the work of grafting may proceed at any time during the winter. The stocks, if not clean, should be washed, and one hand trims off the side rootlets. The grafter cuts a hundred scions of the appropriate length, which he puts into a shallow box on the table; he takes up a stock, cuts the slope near the collar, and a dextrous hand will at the same time make the sloping cut to receive the first graft and also the tongue, if that style of grafting is to be done, as is usually practiced. He then picks up a scion, from a lot which himself or another hand has already prepared with a slope and tongue, and adapts it to the root, the tongue keeping the two together; a portion of the root is then cut off with the graft, and the process is repeated upon the next section. Two or three or more grafts, are thus made from one seedling root; the length of the sections vary from two to four inches, according to the fancy of the operator, or of his employer. Some persons recommend a long scion with a short root and others prefer to reverse those terms. The whole root graft should not be more than six or seven inches long. When any given number of scions are fitted to the roots, a boy completes the process of grafting, by applying melted wax with a brush, in which case they are dropped into water to harden the wax, or they are wrapped with waxed strips of muslin or paper, or, better still, they are tied with waxed thread. No. 3 cotton yarn is drawn through a pan of melted wax, and wound upon a reel placed at the other side of the room, so that the wax may harden, This makes a convenient tie; the graft being held in the left hand, the thread is quickly and easily wound.

GRAFTING WAX. Grafting wax is variously made. It usually consists of rosin, tallow, and beeswax. Sometimes they are mixed in equal parts; but this mixture is hardly adhesive enough; more rosin increases its tenacity. A cheap and useful compound, but sometimes found rather inconveniently adhesive to the fingers, is made of four parts of rosin, two of tallow, and one of beeswax. A coat of the wax, about one-twentieth of an inch thick, spread over muslin, calico, or tough and flexible paper, makes an excellent plaster for out-door grafting; or, if spread half as thick on paper, is well adapted to root-grafting. In either case, the strips should be narrow, that they may be easily wrapped around the graft till it is well covered, when the rest may be torn off. In making the plasters, it is essential that the ingredients of the wax should be thoroughly stirred together before it is spread. A paper, soft, thin, and tough, is used for wrapping. For out-door grafting, in cool weather, a furnace of lighted charcoal is sometimes necessary to soften the wax, but all out-door grafting should be done when the temperature is mild enough to keep the wax soft enough to work.

GRAIN. A term applied to the cereals, as wheat, corn, rye, barley, oats, and buckwheat, or to any seed used as food for man or beast, after being threshed or shelled. For descriptions see the several titles as they occur.

GRALLÆ. The tribe of long-legged wading birds, as the cranes, flamingo, etc.

GRAMINACEÆ. Grain plants. Grasses. Endogenous plants, in which the parts of fructification are essentially perfect, although they are in a very unusual state in what may be called their accessory organs. They have neither calyx nor corolla; but in lieu of them, imbricated scales, called paleæ and glumes: the latter of which give rise to the name glumaceous, often applied to these plants. Grain of all kinds, the bamboo, the sugar cane, many kinds of pasture plants, and reeds, belong to different species of Graminaceæ. They constitute the most valuable family of plants for the sustenance of men and animals. They are developed from the frigid zone to the equator, increasing in size as they proceed south.

GRAMME. The unit of French weights, equal to 15.434 troy grains. The following is their decimal system. Thus, a milligramme is equal to ,001 gramme or, ,01543 troy ounces. The gramme equals the weight of the hundredth part of a cubic metre of distilled water at 32° Fahr. The kilogramme is used for the heavier weights, and is equal to two pounds, three ounces, and 4.428 drachms avoirdupois.

	Grammes.	Troy grams.
Milligramme	,001	,01543
Centigramme	,01	1,5434
Decigramme	,1	1,5434
Gramme	1,	15,434
Decagramme	10,	154,34
Hectogramme	100,	1543,4
Kilogramme	1000,	15434
Myriagramme	10000,	154340

GRANARY. A building adapted to the keeping of grain dry and safe from the depredations of vermin. On most farms the granary is often a series of bins in the barn, sometimes with no attempt to keep them secure from rats and mice. The proper place however, for the granary is a building by itself, raised on posts, capped with large, stout, inverted tin pans, or large, smooth, flat stones. Thus we have a most perfect protection against loss, and if the grain be dry when put in, and properly cleaned, it will always come out sweet and in the best condition for market or seed. In building a granary it should always be with reference to a passage way through the centre, and with doors at each end. The sides should flare somewhat, and the eaves project, so as to keep the sides as dry as possible from storms. Great care should always be taken to have the building strong, that there may be no danger of the weight of grain pressing out the sides. If properly tied to the posts by timbers, and if the siding be made of inch and a half stuff, planed and grooved, put on inside the scantling and firmly nailed, there will be no danger of its being pressed out by the weight of the grain inside. Each bin should have its capacity in bushels plainly marked on it. The number of bushels in the bin should also be plainly marked on a piece of blackboard attached to each bin. This may be a silicate painted directly on each bin, at the time of building. Thus when grain is taken out it may be deducted from the amount previously put in, and at a glance the quantity of grain on hand can be easily figured.

GRANIVORÆ. Birds, including the incessores, which eat grain. Granivorous is used to designate grain-eating animals.

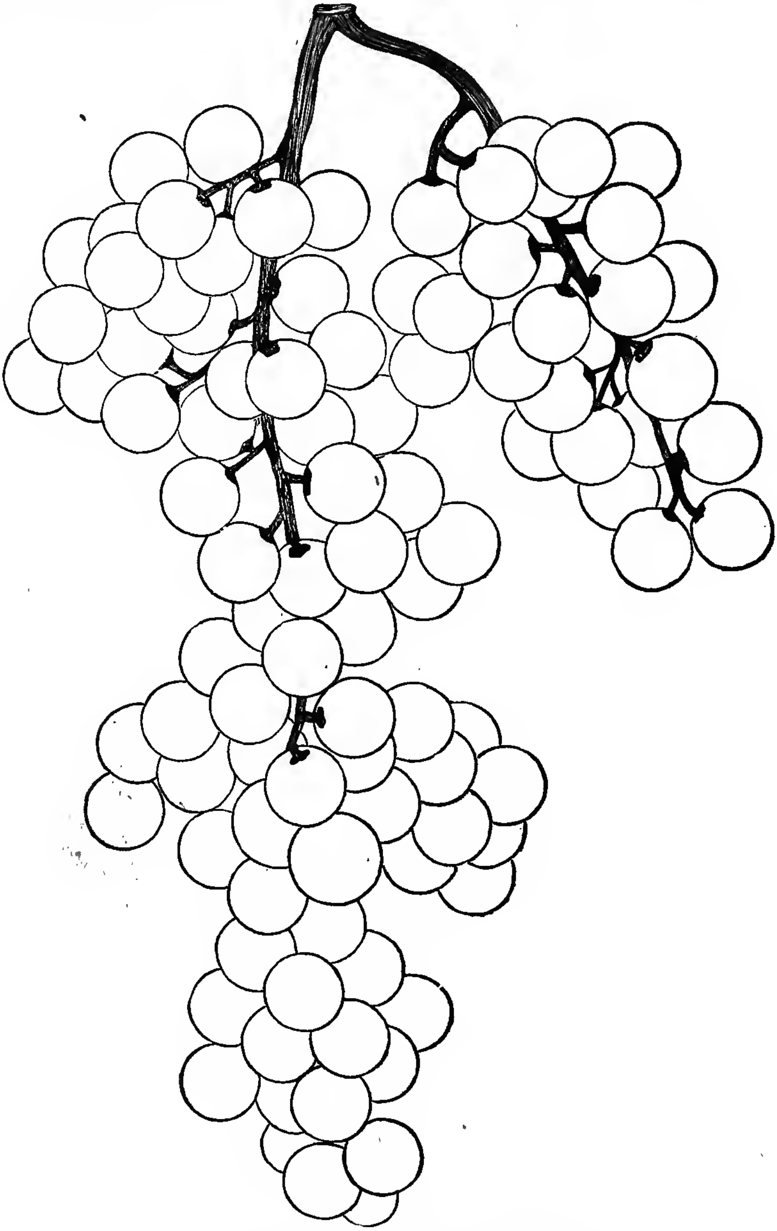
GRANULATE. To form into grains, or become covered with minute granules.

GRANULATION. In chemistry, the reduction of metals into smaller parts; it is performed by pouring small portions of the molten matter into water, and sometimes first passing it through a wire sieve. In surgery, the production of granules of flesh on the surface of wounds.

GRAPE. The grape, during the last ten years, has come fairly to contest the palm, during its season, with the other fruits bought for use by all classes in our principal markets. Since we have ceased to be guided by a hot-house standard, as to what constitutes a palatable grape, and have thrown over the opinions of sybaritic guides, the masses are supplied with this most health-giving fruit in abundance. The Concord grape may be ripened anywhere in the United States up to the Canada line, and also well up into Canada. Along the shores of Lake Erie and Ontario, and west of Lake Michigan, even up to Minnesota, it flourishes everywhere, and may be grown almost as easily as Indian corn. Occasionally a theorist remains who will declare that severe pruning and constant pinching back is necessary to produce fruit. The many get it simply by tying the vines to light posts not extending more than five feet above ground, the laterals being pruned to three or four buds each, the summer pruning consisting simply in taking away the superabun-

VITIS LABRUSCA—VARIETY CONCORD.

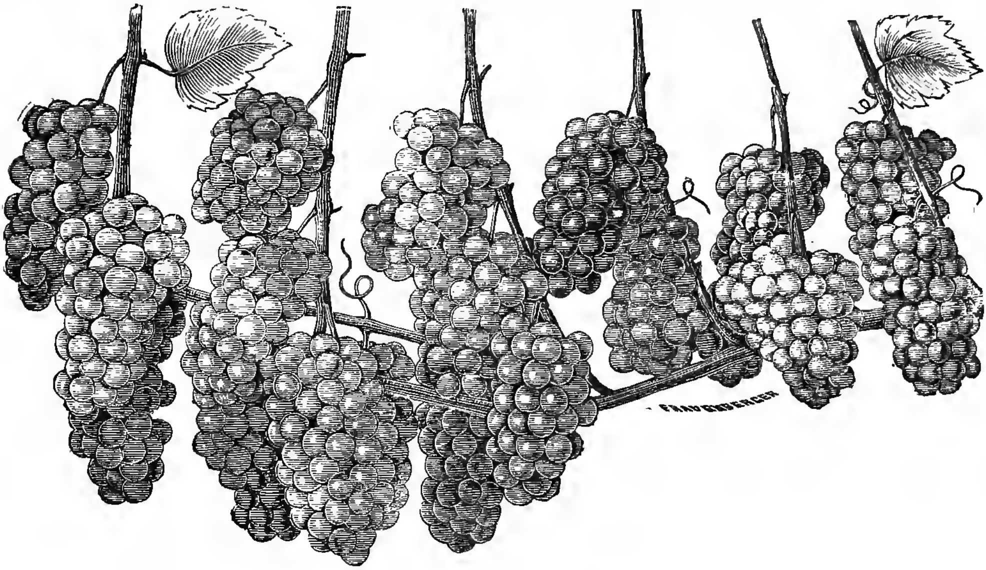
dant wood, up to almost the first or the middle of July, and then letting the vines pretty much take care of themselves. A curious part, not only of grape culture, but of small fruit culture generally, is that the majority of farmers, who should have an abundance of these fruits for daily use



VITIS ÆSTIVALIS—VARIETY, DEVEREUX.

in the family during their season, have less than any other of the middle classes of society, forgetting that $50 worth of labor on an acre of land in vegetables and small fruits would return them more healthful and delicate food for the family than could be bought for the produce of twenty-five acres of corn. Yet it is too often the case that, even of grapes, one or two rambling and neglected vines, only, are to be found near the farm house, when every farmer's homestead should have a vineyard of from thirty to sixty vines, the majority of which for the North should be Concords, with a few vines of other reputable sorts for experimental culture. The illustration will show the Concord bunch full size, the Concord being of the Northern Fox-grape family

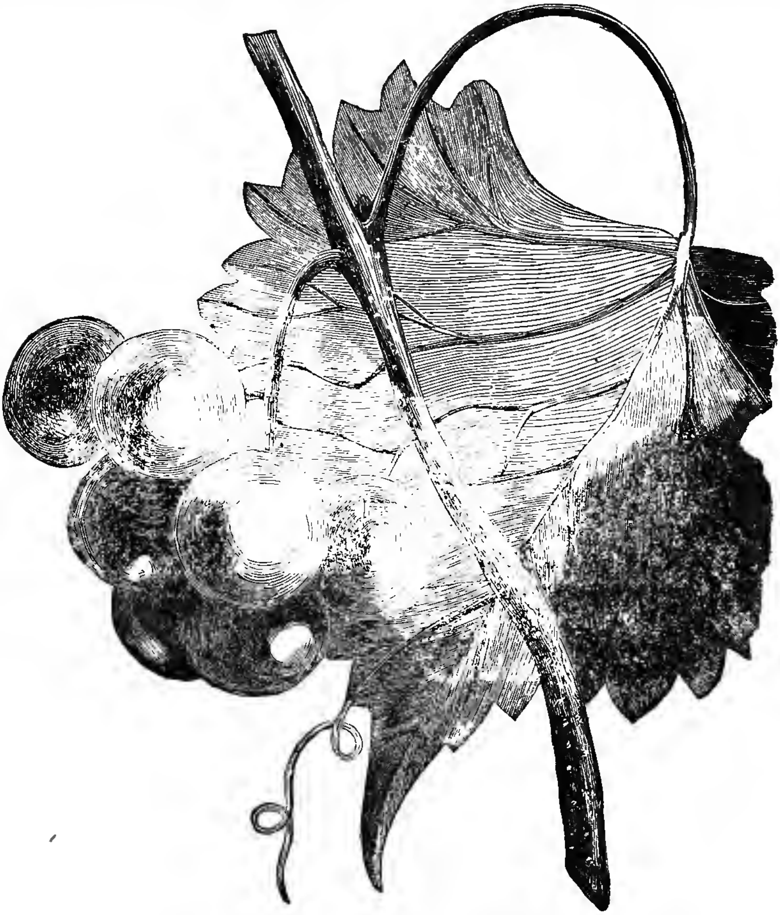
The grape is easily raised from cuttings or layers. One year old vines are the best for transplanting, whatever interested parties may say to the contrary, and any soil not sodden with water in the spring and early summer, and rich enough to raise a fair crop of corn, is good enough to raise those varieties of American grape in common cultivation. The rows for grapes should be eight feet apart, whether the system of cultivation be on trellis or stakes. For Concord, or other strong growing varieties, eight feet should also be allowed in the row. Delaware, and other comparatively weak growing varieties, may be six feet apart in the row. Vigorous varieties, as those like Concord, Diana, and Roger's Hybrids; Delaware, Martha, and this class of grapes, are comparatively weak growers. The cultivation may mostly be done with a five-tooth cultivator, working shallow, but close, next the vines, and deep near the middle of the rows. Thus very little hoeing will be necessary. Whatever the training, whether by winding about stakes, tying them bow fashion back and forth, training for shape or trellising, the annual pruning should all be finished early, and this principally by pinching. The later pruning—and the less the better—is simply clipping off the ends of too rampant and straggling vines. The fall pruning should leave the side shoots cut to about three buds. The Concord, as we before stated, does well on a variety of soils. Delaware likes a rather compact soil, but one not wet; no grape, however, will stand a sodden soil. Perkins is one of the earliest grapes. Hartford seems to like a rather light soil, since on heavy and rather wet soils it is inclined to drop its fruit. Of varieties, every person, except as to Concord, should select those best adapted to his soil, location and system of cultivation. This can only be determined by experiments with sorts that do well on similar soils and locations. The advice in this direction of some practical cultivator nearest you will be of importance in an economical sense.



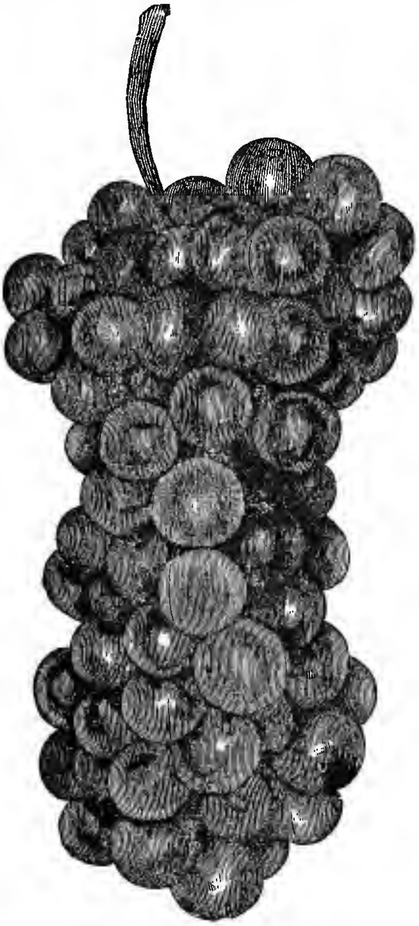
PRENTISS GRAPE.

Of the new grapes, candidates for the popular favor, within the last two years the Prentiss has claims worthy the attention of amateurs, and is of the Labrusca family that has given us so many good grapes. The cut, below, shows not only the great weight and compactness with which the grape may be grown, but is a good showing of the Prentiss as we saw it in 1879 and 1880. The branch is twenty inches long, trained laterally and holding a weight of seven pounds of grapes on laterals bearing two and three bunches each. The description is as follows: Bunch large, not often shouldered, compact. Berry medium to large, yellowish green, sometimes with a rosy tint on side next to sun; skin thin but very firm. Flesh tender, sweet, melting, juicy, with a very pleasant and musky aroma; free from foxiness; little if any pulp; seeds few and small; very similar to Rebecca in quality but vine a vigorous grower, and foliage very distinct from Rebecca. Foliage healthy, thick, resembling Diana or Isabella, showing its native origin. Vine a good grower, productive, said to be inclined to overbear. The following is the classification of grapes with full size illustrations of American species: *Vitis labrusca*, see illustration page 415, variety Concord; *V. æstivalis*, see page 416, variety Devereux; *V. cordifolia*, page 419, variety Clinton; and *V. vulpina*, page 418, variety Scuppernong. Upon these species of American grapes we give the following notes: Vitis labrusca furnishes by far the largest number of varieties. The superior size attained both in bunch and berry, the hardiness and productiveness of the plants, and the fair qualities of the fruit, in many of the varieties, have, no doubt, encouraged the production of seedlings from this section. The Catawba belongs to this class and was brought into cultivation more than half a century ago, and the estimation in which it is still held is proved by the fact that the highest recommendation which a new variety can receive in a published list is that it is as good as a well-ripened

Catawba, and this can be truthfully said of only a very few of even the most popular varieties. The fact that the Catawba suffers so frequently from fungoid and other diseases, and the lengthened season that is required for the perfection of its fruit, have caused it to be in a great degree superseded by varieties inferior in quality but hardier and healthier, and of earlier maturity. For table use, the species in its improved varieties, will probably always occupy a prominent position in a large portion of the Eastern and the Middle States, as well as in the northern sections of the Western States; and in those regions where the climate will not favor the maturity of the best varieties of this class, the inferior kinds will occupy their place. Vitis æstivalis is pre-eminently the wine grape of the Atlantic States. Owing to the fact that none of the varieties except the Elsinburgh will ripen north of the parallel of 40°, unless it may be in some peculiarly favored situation, they have not been extensively planted, and their superior qualities are but little known. The berries are destitute of pulp, and the juice contains a larger percentage of sugar than any other improved American species. The foliage is not so liable to disease as that of the fox grape, and rot in the berries is comparatively unknown. Some of the best wines made in this country are produced from varieties of this family. The distinction, so well understood and acted upon in Europe, between grapes for table use and those for wine, must also be recognized here sooner or later, if the wine interest is to be brought up to any great degree of excellence, and maintained as a source of national industry and wealth. The mountain slopes and plateaux in Virginia, North Carolina, Tennessee, Arkansas, Missouri, and other Southern States must be looked upon as the great producing regions of this continent for a certain class of the wines, not excepting California and other favored sections of the Pacific coast. It is well understood that warm, dry countries produce high wines of much spirit, but greatly deficient in the delicate aroma, exquisite bouquet, and healthful tonic properties possessed by wines produced in climates having a long season of comparatively equable temperature, which have in all ages been renowned for their super-excellent qualities. Vitis cordifolia represents the most healthy grapes of the Northern States. The foliage is rarely attacked by mildew,



VITIS VULPINA—VARIETY, SCUPPERNONG.



VITIS CORDIFOLIA VARIETY· CLINTON.

although the leaves, possibly owing to their smoothness, are occasionally injured by insect punctures. The fruit is not subject to rot, and is noted for keeping well after being gathered from the plant. It is late in maturing, and seems to reach its highest condition by remaining on the vine until the thermometer indicates proximity to the freezing point, when, even in northern localities, it proves to be a fruit of fair quality either for table or wine. Of course its quality is greatly improved by the length and geniality of the season of growth; for example, those who are familiar with the fruit only as a production of Massachusetts would not recognize its flavor and vinous character as ripened in southern Maryland or Virginia. The greatest objection to it as a wine grape is that of having too much acid. The fruit is not so deficient in sugar as is generally supposed, having enough of this important ingredient for a good wine. The grapes of this class have been condemned, it may be with undue haste, as wine grapes, on account of their acidity. Analysis shows that they have a sufficiency of sugar, and it seems probable that the wines only require age to develop their qualities. It is known that wines from the Clinton variety, when kept in a suitable cellar from four to six years, assume a very fine character. There is abundant evidence to favor the belief, that if as much time and care had been devoted to the improvement of this species as has been given to the Fox family, we should now be in possession of a good northern red-wine grape. Vitis vulpina is strictly confined to the Southern States, not growing north of Virginia, and in foliage and wood is very unlike any other grape, either native or foreign. It is peculiarly adapted to a low, warm country, flourishing well in rich alluvial soils, and on the low banks of streams. It is entirely exempt from mildew, rot or any of the diseases so disastrous to some northern species. As a wine grape its unequaled bouquet (perfume) is the principal recommendation. It is deficient in sugar, and the juice is usually gallized, fortified by the addition of alcohol, or otherwise manipulated. In sheltered places, more particularly in cities, many varieties of the foreign grape, *Vitis vinifera*, flourish for a time, and this isolated and partial success maintains a lingering hope in the minds of some persons that the difficulties pertaining to the general field culture of this species in the Atlantic States may ultimately be overcome. There would seem to be, however, no real encouragement for such hope. So many experiments have been made with numerous varieties previous to and during the present century, all ending with the same disappointing results, that we are forced to the settled conviction, that they are not adapted to the climate of this country at least east of the Rocky mountains. On the western coast, in the Pacific States, they form the staple crop of the vineyards and succeed equally as well as in the best locations in Europe, and far better than in some of them, The only cause of failure is that of fungoid growths, or mildew, on the young fruit and foliage. Both the length and warmth of our summers are sufficient to ripen them over a large extent of territory. In Europe they are cultivated from the twenty-first to the fifty-second degree of latitude. The question of grape culture in the United States and Canada is an important one, for not only those who make a business of grape culture are interested but every farmer is interested as well in the raising of those varieties adapted to his soil and cultivation. Where only one variety is to be cultivated the Concord will, of course, be taken, and for the reason, more than once given in this work, that it succeeds almost everywhere where Indian corn will ripen, and in any soil (not subject to long inundation,) adapted to Indian corn. In the tables following will be found varieties adapted to every portion of the United States and Canada. Where it is desirable to cultivate a number of varieties, the reader should find no particular difficulty in selecting from the varieties given. In the far North the variety second to Concord may be Clinton, and then Delaware, if the vines are to be covered in winter, another point wellworthy of reiteration, down to and even below the latitude of 42°, and for the reason, that thus the vines are assured from winter killing. In this connection it should also be remembered, especially in the West, where the summers are steadily warm and rather dry, that, many varieties that would certainly be winter killed, not only as to the buds, but the entire wood if left exposed, yet, laid down and with not more than four inches of earth covering during the winter, they will come out all right in the spring, and perfect their fruit during the summer and fall. Among these varieties may be mentioned all those which survive the winter without protection, from 200 to 300 miles south of a line where they are considered not hardy. In fact, many varieties generally grown in graperies, with glass covering, will perfect their fruit during the hot summers of the West if only the vines can be preserved during the winter as we have designated above. Another thing which should be generally known by those not conversant with the fine art of grape growing, is, that European rules in relation to pruning, especially summer pruning, should be avoided. If the reader will recollect what we have said on this head, he will avoid close summer pruning. To recapitulate, pinch so the side shoots will show three buds in the fall, and after the first of July cut out only superabundant growth. In the fall, before laying down, prune out all superabundant wood that may have been left. Thus your vines may be covered in properly for the winter, and will come out in the Spring ready to tie to stakes. The following is the list of grapes as recommended by the American Pomological Society for different latitudes in the United States, with size, form, color, quality and season of ripening; also, a list of the more valuable foreign grapes for cultivation in the grapery or greenhouse. The columns explain as follows: Size—with reference to the berry; l., large; m., medium; s.,

GRAPES—NATIVE.

Number.	NAMES.	DESCRIPTION.							I.—			
		Size.	Form	Color.	Quality.	Use.	Season.	Origin.	Nova Scotia.	New Brunswick.	Maine	New Hampshire.
1	Adirondac	m.	m. r.	b.	v. g.	T.	E.	Am.	..	..	*	..
2	Agawan (Rogers' No. 15.)	l.	s. r. o.	r.	g.	F. M.	M.	Am.	..	..	**	*
3	Alvey	s.	m. r.	b.	v. g.	T.	E.	Am.	..	..	..	..
4	Barry (Rogers' No. 43.)	l.	r.	b.	g.	T. M.	M.	Am.	..	..	..	..
5	Catawba	l.	m.r.o.	r.	b.	TMW	L.	Am.	..	..	..	..
6	Clinton	s.	m. r.	b.	g.	T. W.	L.	Am.	*	..	..	..
7	Concord	l	l. r.	b.	v. g.	TMW	M.	Am.	*	..	*	**
8	Creveling	m.	m.r.o.	b.	v. g.	T.	E.	Am.	..	..	*	*
9	Croton	s.	l. r. o.	g.	b.	T.	E.	Am.	..	..	..	..
10	Delaware	s.	s. r.	r.	b.	TMW	M.	Am.	*	.	**	**
11	Diana	m.	s. r. o.	r.	v. g.	T. M.	L.	Am.	*	..	*	..
12	Elsinburgh	s.	m. r.	b.	v. g.	T.	E.	Am.	..	.	..	..
13	Essex (Roger's No. 41.)	l.	r.	b.	g.	T. M.	M.	Am	..	..	..	..
14	Eumelan	m.	r.	b.	v. g.	T.	M.	Am.	..	.	†	..
15	Goethe (Rogers' No. 1.)	l.	l. r. o.	g.	v. g.	T. W.	L.	Am.	..	..	..	..
16	Hartford prolific	l.	m.r.o.	b.	g.	M.	E.	Am.	*	..	*	**
17	Herbemont, Warren, etc	s.	m. r.	b.	v. g.	T. W.	L.	Am.	..	..	..	..
18	Iona	m.	m.r.o.	r.	b.	TMW	L.	Am.	..	..	†	..
19	Israella	m.	s. r.o.	b.	v. g.	T.	M.	Am.	..	..	..	..
20	Isabella	l.	m.r.o.	b.	g.	T. M.	L.	Am.	*	..	..	..
21	Ives	m.	m.r.o.	b.	g.	M. W.	M.	Am.	..	..	..	..
22	Johnson (S. C. Seedling.)	....	......	......	......	......	......	......	..	..	..	..
23	Lindley (Rogers' No. 9.)	m.	m.r.o.	r.	g.	F. M.	M.	Am.	..	..	*	..
24	Massasoit (Rogers' No. 3.)	l.	m. r.	r.	g.	F. M.	M.	Am.	..		..	..
25	Martha	l.	s. r.	g.	g.	M. W.	M.	Am.	..	..	..	..
26	Maxatawney	m.	m.r.o.	g.	v. g.	T.	M.	Am.	..	..	..	..
27	Merrimack (Rogers' No. 19.)	l.	s. r.	b.	g.	M.	M.	Am.		..	**	*
28	Norton's Virginia	s.	m. r.	b.	g.	W.	L.	Am.	..	..	..	..
29	Perkins	l.	r.	r.	g.	T. M.	E.	Am.	..	..	..	..
30	Peter Wylie (Doctor Wylie.)	m.	r.	w.	v. g.	T.	......	......	..	..	..	..
31	Rebecca	m.	s. r.	g.	v. g.	T.	M.	Am.	..	..	*	..
32	Salem (Rogers' No. 22.)	l.	r.	b.	g.	M.	M.	Am.	†	..	**	*
33	Scuppernong	l.	r.	r.	g.	W.	M.	Am.	..	..	..	..
34	Telegraph (Christine.)	l.	m.r.o.	b.	v. g.	T. M.	E.	Am.	.	..	*	..
35	Union Village (Ontario.)	l.	s. r. o.	b.	g.	M.	M.	Am.	..	..	..	..
36	Walter	m.	s. r.	r.	b.	TMW	M.	Am.	..	..	†	..
37	Wilder (Rogers' No. 4.)	l.	l. r.	b.	v. g.	T. M.	M.	Am.	..	..	**	*

1 Unreliable.
3 Too small.
5 Suited only to clayey loams and certain localities.
6 Hardy everywhere.
7 Succeeds everywhere.
8 Bunches loose.
9 A promising white variety.
10 Wants rich soil and high culture.
16 Liable to drop from the bunch.

small. Form—with reference to bunch and berry; s. r., short bunch, round berry; l. r., large and round; m. r. o., medium bunch, roundish oval berry; m. r., medium bunch, round berry. Color—b., black, or nearly so when fully ripe; r., reddish or coppery-brownish red; g., greenish-white or yellowish. Quality—g., good; v. g.. very good; b., best. Use—T., table; M., market; W., wine. Season—E., early; M., medium; L., late. Origin—Am., American. * One star signifies doing well; ** two stars, doing very well; † a dagger signifies on trial. As the foreign grapes are for cultivation under glass, they are not subject to those variations induced by climate or soil, and therefore they may be regarded as equally adapted to all localities. Very few of the local committees have made any report in reference to these grapes. The list below contains such as have been already adopted by the Society, with a few others very generally esteemed. In California, Utah, and sections of the Southern States, they require no artificial protection or heat; it has, therefore, been thought unnecessary to tabulate the States and Territories relative to them; but, taking the old catalogue, and simply adding to it a column relative to variety as adapted to a cold house, or its want of fire heat, in our Northern States, the old form is continued. The columns explain: 1st—The color of the fruit; 2d—flavor; 3d—season of maturity; 4th—cold, for a variety that does well without fire heat—hot, for a variety

GRAPES — NATIVE.

	NORTHERN DIVISION. Between 42° and 49°.															II.—CENTRAL DIVISION. Between 35° and 42°.																				III.—SOUTH. DIVISION. Between 28° and 35°.										
Number.	Vermont.	Massachusetts.	Rhode Island.	Connecticut.	New York.	Ontario.	Michigan.	Wisconsin.	Minnesota.	Dakota.	Montana	Wyoming.	Idaho.	Washington.	Oregon.	Pennsylvania.	New Jersey.	Delaware.	Maryland & D. C.	Virginia.	North Carolina.	Ohio.	Indiana.	West Virginia.	Kentucky.	Tennessee.	Illinois.	Iowa.	Missouri.	Nebraska.	Kansas.	Colorado.	Utah.	Nevada.	California.	South Carolina	Georgia.	Alabama.	Florida.	Indian Territory.	Arkansas.	Missi-sippi.	Louisiana.	Texas.	New Mexico.	Arizona.
1	*	*			*	*	*																				*			*																
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6	*				*	*	*									*	*		*	*		*	*	*	*		*	*	*	*	*					*	*	*				*	*			
7	*	**	*	**	**	*	**	**	*						**	**	**		**	*		**	*	**	**	**	**	**	**	**	**					**	*	**	**			*	*	*		
8	*	*			*	*	*	*							**	*	*		*					*						*						*	*	*	**							
9		†	*		†		†									†						*	†				†	†	†	†	†		†		†		*									
10	**	**	**	*	**	*	**	**	**						*	*	*	*	**	**		**	*	**	**	**	*	**		**			*			*	**	*	**		*			*		
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37		*	*		**	*	*	**								*			*					**	*		*												*							

17 Makes the finest of white wine.
18 Unreliable except in a few locations.
20 Valueless at the West.
21 Valued for dark wine.
26 Vines require age to give perfect fruit.
34 The more known the better liked.

wanting fire heat. In flavor, the only distinction is between those that are simply sweet, as the Chasselas or Hamburgs, and those having a distinct musky aroma, as the Muscats.

No.	FOREIGN GRAPES.	Color.	Flavor.	Season.	Vinery.
1	Barbarossa (Prince Albert, Brizola.)	Black.	Sweet.	Very Late.	Hot.
2	Black Champion	Black.	Sweet.	Early.	Cold.
3	Black Damascus	Black.	Sweet.	Late.	Cold.
4	Black Frontiguan	Black.	Muscat.	Late.	Cold.
5	Black Hamburg	Black.	Sweet.	Medium.	Cold.
6	Black Prince	Black.	Sweet.	Medium.	Cold.
7	Black July	Black.	Sweet.	Early.	Cold.
8	Bowood Muscat	White.	Muscat.	Medium.	Hot.
9	Buckland Sweetwater	White.	Sweet.	Medium.	Cold.
10	Calabrian Raisin (Raisin de Calabre.)	White.	Sweet.	Late.	Hot.
11	Cannon Hall Muscat	White.	Muscat.	Late.	Hot.
12	Chasselas Musque, or Joslin's St. Albans (Muscat blanc Hative ?).	White.	Muscat.	Early.	Hot.
13	Duc de Magenta	Black.	Sweet.	Early.	Hot.
14	Early Silver Frontignan	White.	Muscat.	Early.	Hot.
15	Golden Hamburg (Stockwood G. Homburg.)	White.	Sweet.	Late.	Hot.
16	Golden Champion	Amber.	Sweet.	Medium.	Hot.
17	Grizzly Frontignan (Red Frontignan, Red Constantia.)	Red & Yellow.	Muscat.	Medium.	Hot,
18	Gros Colman	Purple.	Sweet.	Late.	Cold.
19	Lady Downe's Seedling	Black.	Sweet.	Very Late.	Hot.
20	Muscat of Alexandria	White.	Muscat.	Late.	Hot.
21	Muscat Hamburg	Black.	Muscat.	Medium.	Hot.
22	Mrs. Pince's Black Muscat	Black.	Muscat.	Late.	Hot.
23	Queen of Nice	White.			
24	Red Chasselas (Rose Chasselas.)	Red.	Sweet.	Medium.	Hot.
25	Red Lombardy	Red.	Sweet.	Medium.	Hot.
26	Rio Virgin				
27	Royal Muscadine	White.	Sweet.	Early.	Cold.
28	White Nice	White.	Sweet.	Late.	Hot.
29	West St. Peter's	Black.	Sweet.	Very Late.	Hot.
30	Wilmot's Black Hamburg (Dutch Hamburg.)	Black.	Sweet.	Medium.	Hot.
31	White Sweetwater (Dutch Sweetwater.)	White.	Sweet.	Early.	Cold.
32	White Frontignan (White Constantia, Muscat blanc.)	White.	Muscat.	Medium.	Hot.
33	Zinfindal	Black.	Sweet.	Medium.	Hot.

GRAPE INSECTS. Grape vines are attacked by numerous insects, on leaf and root, and also by borers. The most devastating and dreaded of late years is the grape Phylloxera, which, having devastated the vineyards of France and other principal vine growing districts of Europe, are now giving vinegrowers in the United States, and especially in California, much trouble. This insect is especially troublesome in the lighter classes of mucky soil and in loams. In gritty soils, or soils containing much sand, the Phylloxera is less dreaded. Dr. C. V. Riley, Chief of the Entomological Commission of the United States, has spent much valuable time in the careful investigation of this enemy of the vine, both in France and in the United States. A synopsis of his investigations will be accepted as correct and valuable both by the scientific and the general reader. Extracts are from the report of the Commissioner in the United States Geological Survey, containing valuable matter in relation to the Rocky Mountain Locust, and other insects. This destructive insect was first found in this country, and was described by Dr. Fitch, in 1856, under the name of *Pemphigus vitifoliæ*. Its proper name is *Phylloxera vitifoliæ*, though most authors speak of it as *Phylloxera vastatrix*. It exists in two forms, one raising irregular galls on the leaves, and the other forming small swellings on the rootlets. The root-form is both wingless and winged, the latter very rare. The leaf-form is said to be always wingless. The wingless female of the leaf-form lays, on an average, 200 eggs, and sometimes 500. There are perhaps five generations in a year. This leaf-form produces round, irregular galls, sometimes as large as a pea, but it does little damage compared with the root-form, which is much more abundant than the leaf-form, especially on native vines, in France, where its ravages have been so alarming that the French government has offered a reward of 300,000 francs for a simple available remedy. The leaf-form descends to the roots in the autumn, and there hybernates. The larvæ of the root-form are at first smooth and like the young of the leaf-form, but afterward molt and become warty, so as to become readily distinguishable from them. Prof. Riley and certain French observers have lately proved that the gall-producers, or the leaf-form, come from the impregnated or winter egg. The winged females begin to appear in July, but are most abundant in August and September. Like the wingless females, they reproduce by budding (parthenogenesis), the eggs not being fertilized by males, no males being in existence. Having issued from the ground while in the pupa state, they rise in the air, and spread to new vineyards, where they lay two or three, sometimes eight eggs. These eggs are of two sizes; and, in about a fortnight, from the larger eggs are hatched wingless true sexual females, and from the smaller eggs wingless males. The abdomen of the female, after impregnation, enlarges somewhat, and she is soon delivered of a solitary egg; which differs from the ordinary eggs of the parthenogenetic mother, only in becoming somewhat darker. Fig. 1, Type *Gallæcola*; *a*, *b*, newly-hatched larva, ventral and dorsal view; *c*, egg; *d*, section of gall; *e*, swelling of tendril; *f*, *g*, *h*, mother gall-louse, lateral, dorsal and ventral views; *i*, her antenna; *j*, her two-jointed tarsus. The figure on the side of each enlarged drawing represents the natural size. This impregnated egg gives birth to a young louse, which becomes a virginal, egg-bearing, wingless mother, and thus recommences the cycle of the species' evolution. But one of the most important discoveries of Balbiani is that, during the latter part of the season, many of the wingless, hypogean mothers perform the very same function as the winged ones; i. e., they lay a few eggs, which are of two sizes, and which produce males and females, organized and constructed precisely as those born of the winged females, and, like them, producing the solitary impregnated egg. Thus, the interesting fact is established that even the winged form is by no means essential to the perpetuation of the species; but that, if all such winged individuals were destroyed as fast as they issue from the ground, the species could still go on multiplying in a vineyard from year to year. We have, therefore, the spectacle of an underground insect, possessing the power of continued existence, even when confined to its subterranean retreats. It spreads in the wingless state from vine to vine, and from vineyard to vineyard, when these are adjacent, either through passages in the ground itself or over the surface; at the same time it is able, in the winged condition to migrate to much more distant points. Fig. 2, Type (root-form) *Radicicola*; *a*, roots of Clinton vine, showing the relation of swellings to leaf-galls, and power of resisting decomposition; *b*, larva, as it appears when hybernating; *c*, *d*, antenna and and leg of the same; *e*, *f*, *g*, forms of more mature lice; *h*, granulations of skin; *i*, tubercle; *j*, transverse folds at border of joints; *k*, simple eyes. The solitary egg above referred to is the winter egg. As autumn advances, the winged individuals become more and more scarce, and only eggs, newly-hatched larvæ, and a few wingless, egg-bearing mothers are seen. The latter are said to die during the winter, and consequently the species in winter is represented by the larvæ and a few eggs. In spring the larvæ molt their winter coat, and, after attaining maturity, lay eggs. The eggs laid by the winged females are placed in the down of the leaf of the vine, but more commonly in the earth around the roots. Fig. 3, Type (root-form) *Radicicola*; *a*, *b*, pupa and imago of a problematic individual, or supposed male; *c*, *d*, its antenna and leg; *e*, vesicles found in the abdomen. As to remedies, one hundred and forty have already been proposed in France, but none are infallible. The best general remedy is flooding the vineyards in autumn or winter. The best specific application has been found to be the bisulphide of carbon, two ounces to be placed in a hole near the root, the earth becoming impregnated, the insects are killed. Dr. Riley has strongly urged the use of those American vines which resist the attacks of the Phylloxera, as one of the best measures to prevent the attacks of this dreaded pest. Dr. Riley supplements the natural history of this insect, showing the means he employed to carry out the rearing of the perfect insect, saying: The results of these endeavors to supply the winged mothers as nearly as possible with the natural conditions have been satisfactory, and they prove that, as was surmised, the eggs are laid in crevices of the ground around the base of the vine, but still more often on the leaves, attached generally by one end amid the natural pubescence, or rather down, of the under surface; and while heretofore all efforts to artificially hatch the progeny from these eggs have, for the most part, failed, I have this year succeeded in hatching them without difficulty. (The illustrations given will show the various stages of the insect, so as to make the whole clear.—Ed.) I have also succeeded in getting both sexes of the American Oak Phylloxera, and in thus completing the natural history of both species. Though this true sexual form of vastatrix, from the winged and agamous female, has never before been carefully observed and described, it was nevertheless anticipated by Balbiani in his studies of the European Oak Phylloxera (*Phylloxera quercus* Fonse.) and by myself in my studies of the American Oak species (*P. Rileyi*). Balbiani had also obtained what is evidently the same from eggs deposited by wingless, hypogean mothers late in the sea-

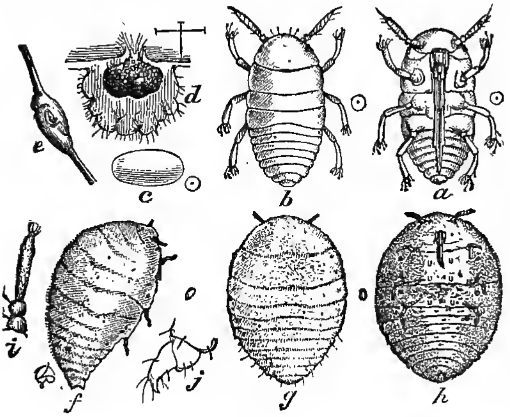


Fig. 1.

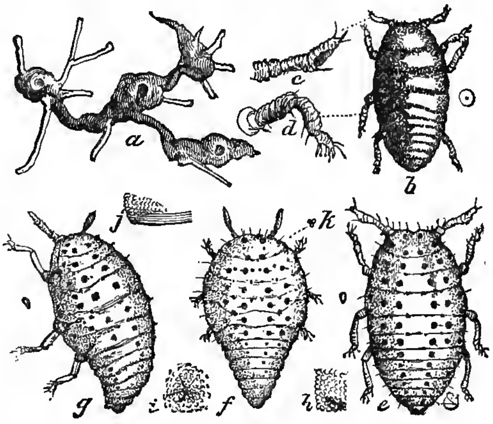


Fig. 2.

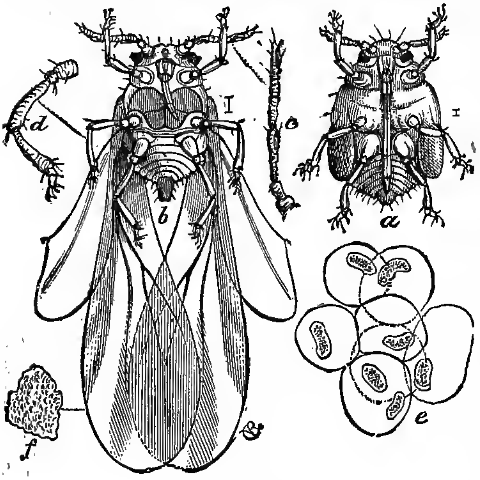


Fig. 3.

son, and after the winged mothers cease to fly. The winged females carry in the abdomen from three to five and sometimes as many as eight eggs. These eggs are of two sizes—the smaller, which produce males, about three-fourths the size of the larger, which produce females. As the whole organization of these aërial mothers—with the stout proboscis and ample wings—indicates freedom and nourishment are needed to bring the eggs to perfection and cause their proper oviposition. In confinement in small vessels, where these requisites are not easily furnished, the eggs are generally voided, with the death of the parent, on the sides of such vessels; and those freely laid are with the greatest difficulty brought to the hatching point. Only in two instances did I succeed in doing this last year. These failures in the past find their explanation not so much in the difficulty of supplying the natural conditions, as in lack of experience as to what these conditions were. The accompanying illustration, Fig. 4, shows Sexed Phylloxeræ: *a*, female *vastatrix*, ventral view, showing egg through transparent skin; *b*, do., dorsal view; *c*, greatly enlarged tarsus; *d*, anal joints shrunken as they appear after oviposition; *e*, male *caryæcaulis*, dorsal view—the dots in circle indicating natural size. Whether owing to the want of down on the Clinton leaf, or that the minuteness of the eggs makes it about as difficult to find them on a square four feet of earth surface as the proverbial needle in a haystack, the eggs found on the vine in the aforementioned muslin enclosure were very few compared to the number of winged insects which must have come out of the ground. It was also next to impossible to find, and quite impossible to follow, the sexed individuals after hatching. In the prepared jars, where the tomentose leaves of Labrusca were kept, I obtained more satisfactory results; for, while a few eggs were laid on the surface of the ground, especially in the space between the earth and the glass, and a few others on the upper side of the leaves, by far the larger number were attached to the under surface, generally by one end and thrust between the natural down of the leaf—evidently showing that this is the natural nidus chosen. The winged mothers die soon after ovipositing and their shrivelled and decaying bodies adhere to the leaf-down. By taking a leaf bearing eggs that are eight or nine days old and enclosing it in a smaller, tightly corked tube, the sexed individuals hatch freely, and are easily watched. This hatching takes place on about the tenth day after deposition, with our late September temperature. The egg perceptibly enlarges during this time, a fact that might be explained by endosmosis of the leaf-juices were it not known that the same fact holds true of many soft insect eggs that are not attached to succulent leaves or other living vegetation. The red eyes are seen through the delicate egg-shell early in the development of the embryo, and just before hatching the joints of the body are perceptible. The egg-shell is so delicate that in the process of hatching it is usually pushed back in folds, and is left as a little wrinkled, whitish mass; occasionally, however, it more nearly retains its original form. The sexed individuals are at once distinguished from all the other forms which this interesting species assumes by the obsolete mouth-parts, the sexual organs and the more highly developed nervous system; otherwise, in size, in smoothness and in obsoleteness of the basal joint of tarsus, they most closely represent the newly hatched larva. The next cut, Fig. 5, Grape Phylloxera; *a* shows a healthy root; *b*, one in which the lice are working, representing the knots and swellings caused by their punctures; *c*, a root that has been deserted by them, and where the rootlets have commenced to decay; *d*, *d*, *d*, shows how the lice are found on the larger roots; *e*, female pupa, dorsal view; *f*, the same, ventral view; *g*, winged female, dorsal view; *h*, same ventral view; *i*, magnified antenna of winged insect; *j*, side view of the wingless female laying eggs on roots; *k*,

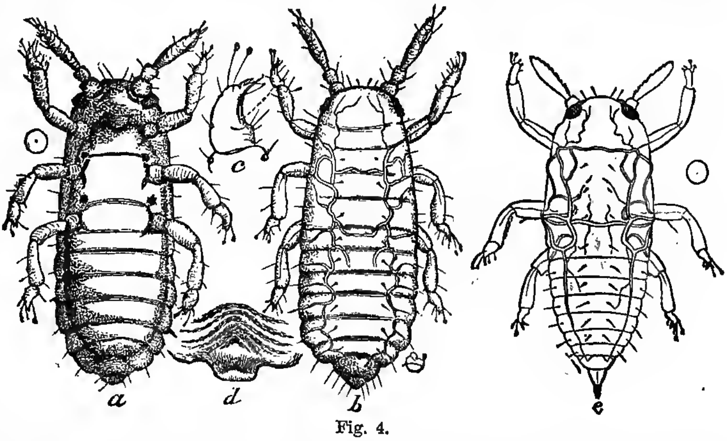


Fig. 4.

shows how the punctures of the lice cause the larger roots to decay. Where this egg is naturally laid I have not yet ascertained, but in all probability it is carried into or near the ground by the impregnated parent. The young hatching from it is the normal agamous female; for, though I have not yet hatched this impregnated egg of vastatrix, I have succeeded in doing so with that of Rileyi, and Balbiani long since did so with that of quercus. I am led to think that, once impregnated, the female carries her egg into the ground, because in 1873 I found females whose abdomens, instead of being filled with numerous small eggs, were distended with a single large one; and, though I was puzzled to interpret the fact at the time, I have no doubt now that I then had under my eyes the true, impregnated female here described, and that I overlooked the obsolete mouth. The habits of these sexed individuals, as I have been able to observe in both the Grape and American Oak species, are similar to those recorded by Balbiani of the European Oak species. The male is quite ardent, more active than the female and somewhat longer lived. The complete natural history of the Grape Phylloxera may now be considered established. A full biological view of the species exhibits to us no less than five different kinds of eggs: 1st, the regular ovoid egg, 0.25 mm. long and half that in diameter, of the normal, agamic and apterous female, as it is found upon the roots; 2d, the similar, but somewhat smaller egg of the gall-inhabiting mother; 3rd, the ♀ egg from the winged mother, rather more ellipsoidal, and 0.50 mm. long when mature; 4th, the ♂ egg from same, one-fourth less in length and rather stouter; 5th, the impregnated egg, just described, 0.32 mm. long and still more ellipsoidal. We have also the singular spectacle of an egg from the winged mother increasing from 0.34 mm. (its size when laid) to 0.40 mm. (its size just before hatching) giving birth to a perfect insect 0.40 mm. long and this in turn without any nourishment laying an egg 0.32 mm. long. A being is thus born, and, without food whatsoever, lays an egg very nearly as large as that from which she came. From observations here recorded I would draw the following conclusions: 1. We can no longer really entertain the hope of any practical good from the knowledge of the nidus chosen by the winged mothers, as the destruction either of these or of their eggs—scattered as they are on the leaves all through a vineyard—is out of the question. The objects are too small to be practically searched for, and it is virtually impossible to prevent the spread of the disease in this stage. We might almost as well try to prevent mildew

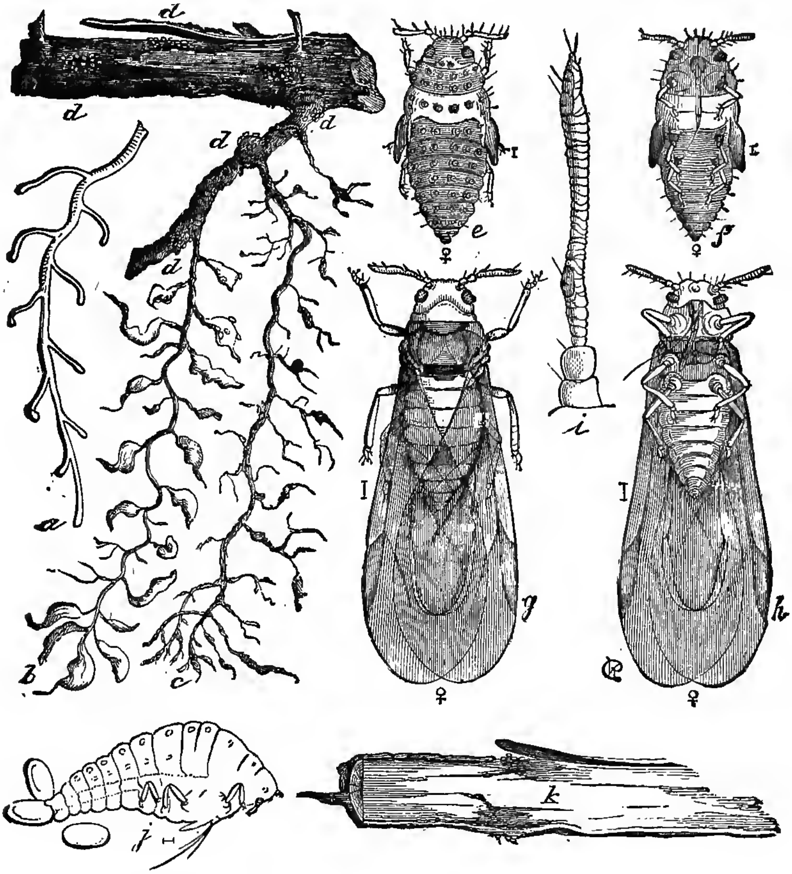


Fig. 5.

by the destruction of the invisible floating spores that must at times pervade the atmosphere of a vineyard. The hope entertained by Lichtenstein that the winged mothers would congregate and be attracted to some particular plant must, it is thought, be abandoned. 2. The only preference shown in this respect would seem to be for those leaves that are most downy or tomentose; and from this view of the case we get another probable reason why the varieties of Labrusca which are characterized by an abundant downiness on the under surface of the leaves suffer most from the insect. 3. Having already had the young from the impregnated egg of Rileyi hatch in about a fortnight after it was laid; having shown in previous writings that this species winters in the larva state, and not in the impregnated egg as does the European quercus; remembering, further, that vastatrix resembles Rileyi in wintering as larva, it is safe to conclude that the impregnated egg of vastatrix will hatch the same season that it is laid, and that we can not apply to it the term winter egg which Balbiani applies to the impregnated egg or quercus. It is not unlikely that, since a few of the winged females issue as late even as the latter part of October, some few also of the latter produced impregnated eggs may pass the winter unhatched; if so, they may be considered exceptions to the rule. In the same way, a few of the more common eggs from the agamous male may be exceptionally found on the roots in winter, though as a rule only the hybernal larva is found. Concluding, Dr. Riley states that a succeeding year's study of both Vastatrix and Rileyi confirm him in the opinion, maintained in a previous report, that the term pupa, as applied to the sexed eggs by Lichtenstein, is quite unwarranted, and that the egg-covering, thin and plastic though it is, can in no sense be likened to a cocoon, and still less to a silken cover. The fact of its shrivelling up makes it none the less an egg-shell, for this shrivelling process occurs in all eggs with very delicate and plastic covering, and may, indeed, be witnessed in the gall-inhabiting form of vastatrix, though no one has thought of questioning the ovarian nature of the eggs found in those galls. The foregoing, given at considerable length, will be found important to vineyardists. Another destructive insect, infesting the grape, is the Red Shouldered Synoxylon (*Synoxylon basilarie*), Fig. 6—*a*, larva; *b*, pupa; *c*, perfect insect or beetle; a blight insect boring under the bark, as well as in the heart of the stems. Its depredations are not confined to the grape, for it also attacks the apple, and the hickory, boring straight to the heart of the tree. Infested twigs should always be burned. The Grape Forester may also be mentioned here as eating the leaves of the grape. The miller has a black hue with two large spots on each of its wings. Those on the forewings white and those on the hindwings yellowish, (see illustration given below, Fig. 7), *a*, caterpillar, *b*, side view magnified, *c*, moth. The caterpillar is banded with whitish-blue with black lines, and on the middle of each square is a broad, orange-yellow band dotted with black. Hand picking is the remedy. Of the four next beetles figured, the Editor of the Report on the Rocky Mountain Locust, says of the grape-vine colaspis, that it is one of the worst of the forty or fifty different insect enemies of the grape-vine. The beetle ranges from New York to Illinois and Missouri. It is cream-colored and black, with long club-shaped feelers nearly a fifth of an inch long; the head and prothorax are reddish-yellow, while the wing-covers are black. Hand picking is the best remedy. The cut, Fig. 8, shows at 1, beetle; 2, natural size; *a*, larva, *b*, end of body enlarged, the hair line showing the natural size. The larva has been found by Prof. Riley to feed on the roots of the strawberry. It transforms in the ground. Of the Vine-Leaf Hopper, he says it abounds East, when the grapes are ripening, is pale yellow, with two broad red bands and a third dusky one at the apex. It is a little over a tenth of an inch long. It swarms on the leaves in August, puncturing them with its tiny beak, and drawing out the sap until the leaves turn yellow and become dry and stiff

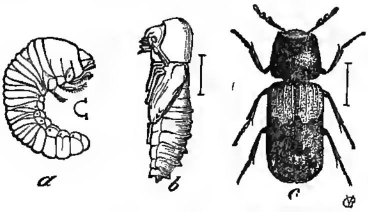


Fig. 6.

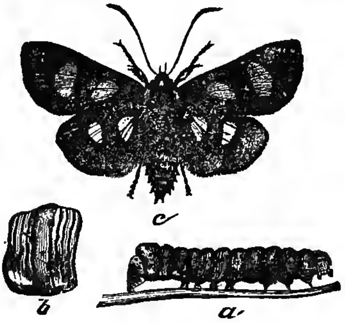
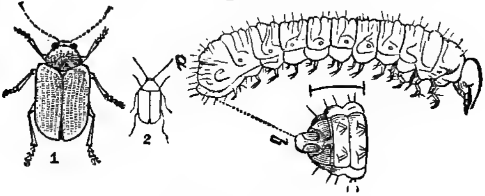


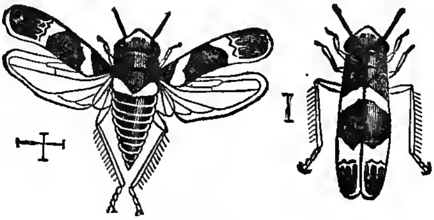
Fig. 7.

Fig. 8.



GRAPE-VINE COLASPIS.

Fig. 9.



VINE-LEAF HOPPER.

The young appear in June, and the leaves are thus depleted for a period of nearly three months. They wither, and hence the plant becomes enfeebled, little new wood is formed, and the canes do not ripen well, and the fruit is stunted and easily mildews, while in a few years the vine become exhausted and barren. The leaf-hoppers hybernate, and lay their eggs in the spring As a remedy, wash the vines with soapsuds in June, and, if possible, fumigate the leaves with tobacco. These are among the worst of the insects attacking the grape. Another insect, rather rare, but destructive, is the Broad-necked Priornus. This is, however, a general feeder working in a number of trees, and will be treated of under its proper name.

GRAPERY. A house similar to a green house, but devoted to the raising of exotic grapes. They are of two kinds; those depending entirely upon the spring, summer and autumn's sun for ripening the fruit, and those heated artificially, for winter forcing. Since the introduction of ripe grapes from California, graperies are becoming less and less used in the United States by the wealthy. But in England they are still extensively used for forcing grapes, since the heat of the climate of Great Britain will not ripen any variety of cultivated grape without more or less artificial forcing.

GRAPE SUGAR. *Glucose.*

GRAPHOMETER. A name for the semicircle of land surveyors.

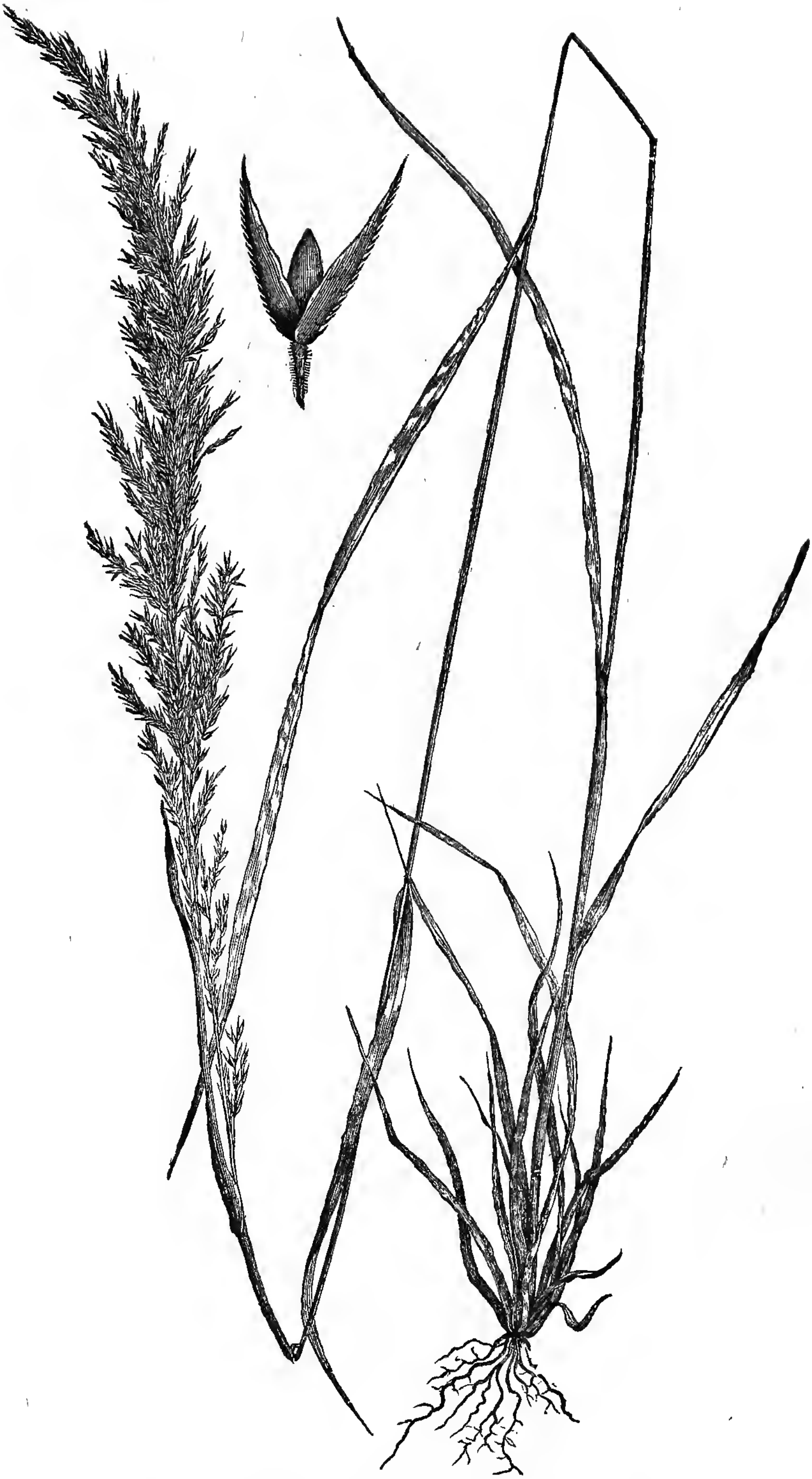
GRAPHITE. Plumbago, black-lead. The coarse kinds are used in making crucibles.

GRASSES. The great order of plants included in the Gramineæ, or true grasses, are described botanically as having mostly hollow stems (*culms*) which are cylindrical and jointed, closed at the joints (*nodes*), leaves alternate, two-ranked, parallel-nerved, the dilated petiole (*sheath*) surrounding the culm and split open on the side opposite to the blade, and furnished at the junction of the blade with a more or less manifest scarious appendage (*ligule*). Flowers perfect, polygamous or monœcious (rarely diœcious), imbricated with two-ranked glumes or bracts, the outer pair (glumes), substituting a spikelet of one or several flowers, the inner pair (*paleæ*), enclosing each particular flower which is destitute of a proper perianth. Stamens one to six, usually three anthers, versatile. Ovary one-celled, one-ovuled, usually with two or three scales (*squamulæ*) at base. Styles mostly two or two-parted; stigmas plumose or hairy. Fruit a seed-like grain (*caryopsis*); embryo small at the base and on the outside composed of copious farinaceous albumen. Annuals or perennials, with fibrous roots, often *cæspitose.* Spikelets paniculate or spiked, upper (inner) palea two-nerved or two keeled. This vast order—comprises some two hundred and thirty genera, and perhaps not less than three thousand species, says Dr. Darlington, and is probably the most generally diffused and the most important to man, of all the families of plants. The seeds, and herbage, furnish a principal portion of the food of the human race, and of the more valuable domestic animals. A great number of the grasses, however, are little better than weeds, on a farm, and some of them exceedingly annoying. Those which the American agriculturist is more immediately interested in knowing, are here given. Those specimens with which the farmer and planter are most intimate may be composed in the Poa Sub-family, the Phalaris Sub-family and the Panicum Sub-family, and are as follows: I.—Poa Sub-Family contains 1. Leersia. 2. Oryza. 3. Zizania. 4. Alopecurus. 5. Phleum. 6. Agrostis. 7. Muhlenbergia. 8. Calamagrostis. 9. Cynodon. 10. Eleusine. 11. Dactylis. 12. Glyceria. 13. Poa. 14. Festuca. 15. Bromus. 16. Phragmites. 17. Arundinaria. 18. Lolium. 19. Triticum. 20. Secale. 21. Hordeum. 22. Avena. 23. Arrhenatherum. 24. Holcus. II.—Phalaris Sub-Tribe contains 1. Anthoxanthum. 2. Phalaris. III.—The Panicum Sub-Tribe: 1. Paspalum. 2. Panicum. 3. Setaria. 4. Cenchrus. 5. Tripsacum. 6. Zea. 7. Saccharum. 8. Andropogon. 9. Sorghum. Of the last Sub-family we shall only notice those adapted to cutting green for forage, and those adapted to the pasture and meadow. Grass is the prime integer in all farming. The hay crops of the United States are the most valuable single crops cultivated, and grass for summer pasture ranks higher than any. It makes pasture in summer, and forage in winter, and all farm stock in any country are dependent upon it almost exclusively for food, for even in fattening with grain—corn, oats, barley, etc.,—we depend upon the seeds of this beneficent family of plants. The Cruciferæ which includes cabbage, rape, mustard, turnips, etc., are valuable in England. The Cucurbitaceæ, which includes pumpkins, squashes, etc., find a large place in feeding stock in many portions of the United States. The composite family, the largest of the natural families, furnish artichokes and a few others seldom used; but it is remarkable in its lack of useful species although wonderful in ornamental ones. The night-shade family gives us the potato. The parsley family gives us the carrot, the parsnip and some others of value, and the goosefoot family furnishes the sugar beet and mangelwurzel, valuable for feeding in the West. Nevertheless, all placed together are of but little account in comparison with the great grass family, which includes our cereal grains. In fact, grass is of more value to man, than all other plants combined. Vastly more than half of all vegetation—as to its value to man—is contained in this family. In 1870, the hay crop alone of New York, exceeded seventy-seven millions of dollars; in Pennsylvania, over thirty-five millions; in Ohio, over twenty-one millions, and in Illinois, more than twenty millions of dollars. The truth of the text, All flesh is grass, will thus readily be understood, and also the statement that Grass is King among the crops of the earth. Prof. W. J. Beal, of the Michigan Agricultural College, one of the most accomplished botanists in the United States, describes the botany of grasses, in the following simple and common-sense language: The term grass, as used in common everyday life by many people, is applied to all those plants which are used for pastures and meadows. This is a classification founded upon use alone, disregarding all the other features of the plants. It is like calling every thing a fish, because it lives in the water, or birds and insects because they can fly. These are superficial or artificial classifications, and have no scientific value whatever. In like manner a great variety of grasses and other plants are known by the same name in different parts of the country, or one plant is known by a half a dozen or more names; so such names often are very puzzling, and afford very little guide as to what is meant. If one asks about drop seed, or blue grass, or fox-tail, or fowl meadow grass, or wire grass, or red top, we must first know the Latin name of the grass, or we are by no means sure that we understand each other. The trouble is greatest among plants like grasses, where the resemblance is often very close to inexperienced eyes. I believe there is little or no prospect that people will ever agree on the common names of many of our grasses. Our first lesson in botany will be to learn how to distinguish true grasses when we see them. Take in your hand a straight stalk of Indian corn —for this is a true grass—the leaves are on the alternate sides of the stem, one at each solid joint, making two ranks or rows from top to bottom. As you look at a straight stem of grass, the leaves may appear to you right and left, or they may appear on the side of the stem next to you and away from you. The leaves have no teeth or notches along their edges. They can be stripped into many fibrous threads, i. e., the veins are nearly parallel with each other. Observe further that the lower part of each leaf forms a sheath which surrounds the stem. This sheath may overlap, but never grows fast to the stem, except at the joint, nor does it close opposite the main part of the leaf so as to form a tight tube. It is naturally split down to the joint, and may be unrolled like a scroll without tearing away part of it. In botany, it does not generally do to put very much stress upon the structure of the leaves, but in this case it is of much importance. If you understand me so far, and can apply the knowledge, you can never be deceived as to what is a grass, and what is not grass, among all our native or cultivated plants. This point gained is well worth an hour of study. All grasses, in their healthy condition bear flowers at some time of their life. The plan of the flowers is well illustrated by a head of chess, or rye, or wheat, or June grass. Usually two or more flowers (sometimes one) are included within two short leaf-like bodies called glumes. Each perfect flower has from one to six (usually three) stamens, with anthers attached by a point (versatile). Outside the stamens are usually two small green leaf-like bodies called palets, one of which has two ribs, with a thin strip uniting them. In the center of the flower is never more than one pistil, making a fruit which is called a grain. The embryo or germ of the plant is just at one end, on the side, and is the part first eaten out by mice and squirrels in Indian corn. This is by no means all that applies to the botany of grasses, but enough for our present purpose. The grasses are much alike, and few botanists know them, as they are thought to be too hard, and the flowers too small, to master without much hard study. In Indian corn the flowers are of two kinds, each incomplete in itself. On top of the stalk the branching tassel produces an abundance of fine dust called pollen. On the side of the stalk are one or more short branches, covered with a cluster of leaves, from the tip of which extend a large number of slender threads. The branches become the ears, the leaves about them the husks; the threads are often called silk. One of these long, delicate threads runs down to each one of the embryo kernels of corn. That each may become a kernel it is first necessary that a grain of pollen from the tassel should fall upon the silk. Hence it grows or thrusts out (the pollen does) a very delicate prolongation all the way down to the young kernel. If the pollen from one variety of corn fall on the silk of another variety, we get a mixture, so our seed will not be pure. In wheat, red top, oats and timothy, the flowers are perfect, having the stamens pistils, the tassels and silk growing from the same flowers. Our new varieties of wheat and oats, doubtless, are produced in a manner similar to the mixing of Indian corn. As the pollen of corn is known to exert a marked influence on the kernels of corn, it probably, also, has something to do with their size and vigor. The pollen should come from large, healthy plants, as well as the ears. Every breeder of animals knows the importance of selecting good males as well as females. The pollen is the male flower, or part of the male flower. To get the best seed it it not enough to select the best ears of a field, but a small patch should be planted, from which the farmer ought to remove, before flowering, all the tassels of the stalks which are not fully developed, or such as are not likely to produce good ears. A similar plan is worth trying to remove wheat, rye, oats and barley, i. e., cut out from a small plat all the feeble heads, to prevent the bad influence of poor pollen. A great deal has been written, first and last, of the value of chemical analysis as a means of determining the value of a soil for certain crops, and also as determining the value of various foods, including the grasses in feeding and fattening animals. This has never been found of special practical value, except in a general way, and our best chemists now acknowledge this fact. It has been contended by theorists that certain grasses, and the hay, could be made available in feeding for growth, while other varieties could be used as a means of fattening the mature animals. In fact this is nonsense. The best success in feeding for the dairy is in those regions adapted to the growth of a great variety of grasses, which will stand year after year as permanent pasture, and become thicker and thicker, the object being not only to get a succession that will continue from week to week during the whole season, but also grasses that are rich, succulent and sweet, and that may be pastured close and that will again spring up quickly. In growing for beef this is not so essential, particularly in the West, where grain food is so abundant and cheap. The object in this case is flush pastures, of nutritious grass where cattle may quickly fill themselves and thus be kept quiet. For the growing animals old, short pastures supplemented with other food, so that the animals may be fully fed for the night, will be indicated, and feeders in each section of country must experiment with varieties for themselves. This is necessary from the fact that in the United States but few experiments have been made in this direction, by the States, or the general government, or by our agricultural colleges, and it is a matter that can only be accomplished in the best manner at public institutions, and for obvious reasons. In England the most careful experiments have been carried on in relation to the value of the various grasses for different soils and situations, and also in relation to their value as to season Thus the feeder for flesh may select: 1, Red clover, (*Trifolium pratense*); 2, White or Dutch Clover (*T. Repens*); 3, Timothy, (*Phleum pratense*) a better name for which would be Cats-tail grass, and, for the reason that in some sections of the country it is called Timothy, as in Pennsylvania, and Herd's grass in New England and New York. Neither of these names give an indication of its characteristic flower-head, while the former names do; 4, Blue grass, (*Poa pratensis*); 5 Wire grass, (*Poa compressa*); 6, Red Top, (*Agrostis vulgaris*). (Here again confusion of names comes in. In Pennsylvania Blue grass is called Green grass, and Red Top is called Herd's-grass.) 7, Orchard grass, (*Dactylis glomerata*); 8, Fowl Meadow grass, (*Poa serotina*); 9, Meadow Fescue, (*Festuca pratensis*) For feeding during droughts, Indian corn, sown at the rate of two bushels per acre, in drills two feet apart, cultivated thoroughly once or twice, and cut when in blossom will make a good reliance, as also will German millet (*Panicum Germanicum*), and common millet (*P. miliaceum*). Here we have nine varieties of grass that do well generally. One, two, three, four, five, and six, constitute the bulk of the grasses cultivated for pasture; and one and three that for hay. Number seven is one of the most valuable in the whole list, and should be tried everywhere, on land not wet. Eight and nine are also well worthy of trial. Fowl meadow grass especially has been found to take the place of blue grass, in those sections of the Northwest where blue grass does not succeed. Especially has this been the case in Wisconsin. It is hoped it may be found so in the Southwest, where blue grass is not natural to the soil. Mr. Frank E. Hoyt, a careful farmer of Wisconsin, in relation to this grass, says he knows of no grass in the Northwest that will compare with it, either for pasturage or the production of hay. It has never been winter or summer killed, and he has found one acre of marsh well set in fowl meadow equal for pasturage to three acres of upland, set in blue grass, and the hay produced the second year after seeding has never failed to pay the entire expense of cultivating and seeding the land. Fowl meadow hay is especially valuable for horses having all the advantages of wild hay, being free from dust, that infests timothy and clover, while it possesses all the nutriment of the best tame hay; and those dairymen who are acquainted with it, pronounce it valuable hay for milch cows. In all new countries the dependence must, of course, be first upon the wild grasses. As a rule these have not been sufficiently appreciated. Many of them are of exceeding value, but, unfortunately are, as a rule, sparse seeders, and hence are apt to be neglected. The trouble is that farmers, as a class, do not investigate and experiment enough for themselves. Thus they are content with the most meagre list of grasses, and as a result, for a good part of the season their stock find insufficient food of proper succulence, and oftentimes are really distressed for subsistence. There are many native and indigenous grasses in the West. A very considerable list of those will ultimately be found valuable. Prof. Beal gives a list of sixty-five true grasses, excluding cereal grains and clovers, found on the Michigan Agricultural Farm, the most of them indigenous. In Illinois, says Prof. I. A. Lapham, there have been 105 native grasses, (none peculiar to the State), eleven introduced, and twelve that are known as they are cultivated; a larger number, in proportion to the whole number of flowering plants in the States, than is usual in the same climate. This is owing to the extent and shape of Illinois, stretching from Lake Michigan to Kentucky. It has all soils, woods, prairie, and borders of lake and river. But it is not to any one species of grass that we should look for the support of our stock. On the native prairies we find many species intermingled, each doing its part, some preferring low, wet situations, others grow only on dry ground; some prefer the shade of forest trees, while others flourish best on the most exposed parts of the broad prairies; some grow only in the water, others along the margins of lakes and streams; some attain their maturity early in the season, others late in autumn. Of the grasses examined by Prof. Beal, we append the following concise and interesting descriptions, with their botanical and common names. It will be found valuable for the notes on pernicious, as well as on valuable species: *Phleum pratense*, called Timothy or Herd's grass in New England and Michigan, but in Pennsylvania they mean *Agrostis vulgaris* when they say Herd's grass. One name is said to have been given to this grass after Timothy Hanson, of Md., who raised it many years ago. Another name comes from Mr. Herd, who is reported to have found it growing wild in New Hampshire, over 100 years ago. In England it goes by the name of cats-tail grass. This grass in many places has become very popular. There is reason for this. It is a good grass, and will thrive under a great variety of circumstances. It is easily recognized. Another reason still, which I think is not least, the seeds are quite large, pretty, and easily known, so men know what they are buying. It is fashionable and popular. It thrives on soil dry or moist, light or heavy, particularly the latter—not on sand. It is often sown with red clover for meadows, but flowers considerably later. On account of a bulb or thickening of the stem at the base it should not be cut very near the ground. The second growth after mowing does not start very readily. For pasture it is too coarse, and should not be sown alone. The bulbs are eaten off by sheep. It is not so popular in Europe as here. *Agrostis vulgaris* is known as Herd's grass in Pennsylvania, but in most parts of the country as red top. In Rhode Island it is called Burdin's grass and in other places Red bent grass or Summer-dew grass; sometimes Fowl Meadow grass or small red top; one variety is called Fine-top in Massachussetts. Here you see the absolute necessity of the one double Latin name, *Agrostis vulgaris*, not used for any other plant. It is a valuable grass thriving on moist soils, flowering rather late, with timothy, or later. It makes good pasture, good hay, though rather light for its bulk. It is not very rich in starch, gum, sugar or silex. It is a native perennial, not well adapted to sow for one crop, followed by plowing. Very variable in appearance—not much esteemed in England. *Agrostis alba*, White bent grass, or Fiorin thrives on moist and fertile soil, and varies much in its appearance. The stem bends down and roots at the joints. It is valuable for pasture early and late. Second crop small in meadows; quality good, used for making hats in Europe; a native of Europe, Asia and America; the same as red top. *Agrostis Stolon-*

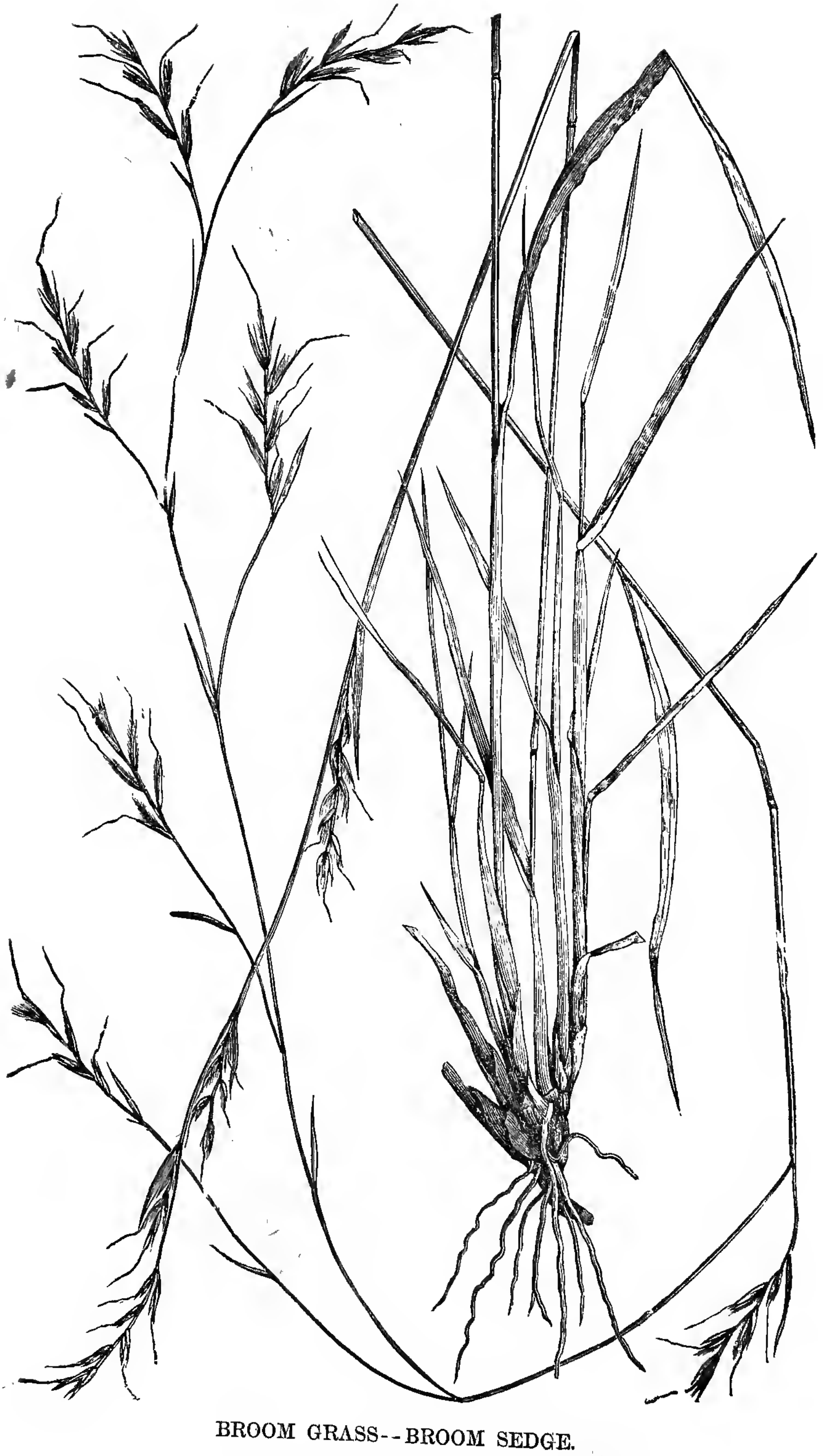
ifera is a variety of the above, about the same quality; thriving on drier land; a foreigner highly praised in Europe. It is hard to kill on account of underground stems which run somewhat like those of June grass. *Agrostis perennans*, Thin grass, grows wild in woods and shaded places. It is rather feeble, yet of good quality, and of some value for seeding in the shade. It is quite pretty. *Agrostis scabra*, Hair grass, has very long branches on the top; leaves shorter than the above; the top more slender and longer; quality much as the last. The long slender tops, when ripe, break off, and are driven to long distances by the wind, rolling them over and over. I have seen them twenty feet high, in the tops of trees, and next to the woods I have been able to gather up my arms full of such tops at a single effort. In this manner the seeds are widely sown. *Poa pratensis*, June grass, Green grass, Meadow grass, Blue grass, Spear grass, Kentucky Blue grass. This grass is widely distributed, both in the old world and in the new. It flowers early in June, thriving on high or low land, but does not seem adapted to thin, poor soil. It is very highly prized in England; also in Kentucky and in many parts of other States; yet in some places it is regarded as a troublesome weed, running and spreading after the manner of Quack grass. It makes excellent rich pasture, and is our best grass for lawns; but for meadows it is rather short. It should not be judged, however, by its short, early flower stalks, but by its long leaves produced in abundance throughout the season. These leaves are frequently two feet in length, when allowed to grow for a time. It is not well adapted to alternate husbandry, as it requires more than one summer to get well established. It is nearly always abundant in all pastures, working, or winning its way where a persistent effort is not made to keep it out. The straw is used for leghorn hats. It is our best grass for pasture, all things considered, milch cows fed on it making excellent butter and cheese; prominent in European pastures and those of the Northern States. *Poa compressa*, Blue grass, Wire grass. Its habit is much like June grass, though it prefers dry soil. The stems are hard, dark green, and easily known by being flat or compressed, remaining green and sweet for a long time after the seeds have ripened. It shrinks the least in drying of any of our grasses. For pasture it is exceedingly rich, and much liked by all kinds of stock. Cows fed on it make excellent butter and cheese. For meadows it is small and wiry; hard to cut, soon gumming the scythe, or knives of the reaper. It is valuable for dairy regions, creeping in old pastures like *Poa pratensis* and white clover, though much less abundant. It does not make much show. *Poa serotina*, False Red Top, Late Poa, Swamp Wire grass was first called Fowl Meadow grass, because it was thought that the seeds were introduced into a meadow by ducks (wild fowl) in Dedham, Mass. The stem is evergreen, like that of Blue grass. It is tall, thriving on low wet land; good for meadow or pasture. The hay is soft and nutritious. A very valuable grass—common on low land. *Poa annua*, Dwarf or Early Meadow grass, is found everywhere in old pastures and about dwellings, making much trouble by constantly springing up in paths and drives. It is pale green, sweet, short, and early, fit for pasture only; also common in Europe. *Poa trivialis* is highly prized in Scotland and England; not much esteemed in this country. *Calamagrostis Canadensis*, Blue Joint, Reed grass. This is a large native, thriving in wet places, giving a big yield of rather coarse hay. Cattle eat it greedily, if cut in the proper season, early. It thrives with Fowl Meadow grass. *Bouteloua curtipendula*, Musquit or Mesquit grass. This is considerably cultivated in the Southern States, and is a favorite grass with many. *B. oligostachya* or Buffalo grass, is said to cover the best portion of Salt Lake Valley and the valleys of the Rocky mountains. It has not succeeded in Pennsylvania It is thin and too short for hay. *Dactylis glomerata*, Orchard grass or Rough Cocksfoot, is a native of Europe, where it has been grown over a hundred years, meeting with great favor as pasture and meadow. It ripens early, about with red clover. It starts very soon after being mowed. It is very nutritious; stock like it; should be sown thickly and cut early. In many places of England it stands highest of all grasses in value. Its growing in tufts, is one objection to it. It thrives very well in shady places. *Alopecurus pratensis*, Meadow Foxtail, is something like Timothy in appearance. It is softer, shorter, earlier, light, sweet, and highly prized in old pastures of England and Scotland. It requires three or four years to get well established. It is not large enough for meadows. At Michigan Agricultural College it ran out on new land, when sowed for pasture with orchard grass, June grass and White clover. It starts well as a second growth; thrives in some parts of Massachusetts; requires a soil of clayey loam. *Cinna arundinaceæ*, Wood Reed grass, Indian Reed grass—Reedy Cinna—thrives in moist woods and swamps, often four feet high. It looks well, though has gained no reputation. *Muhlenbergia glomerata*, Drop seed, though not the one mostly known by the name of Drop seed; thrives in bogs and marshes. It has a hard stem at the base, and a stout rhizome. Cattle like it, but it has not had a fair trial. *M. Mexicana*, thrives in smaller places with the last; is taller and more branching; rootstalks similar. It flowers late; of some value. *M. sylvatica* is found in rocky woods; slender; looks well; stock like it; stout rhizome; worth a trial. *Brachyelytrum aristatum*, Dry, rocky woods; scarce; looks well; is eaten greedily by stock. *Eatonia Pennsylvanica* thrives in moist woods and meadows. It is soft, thin, looks well; cows are voraciously fond of it. It does not seem very hardy. *Eatonia obtusa* grows on dry soil, with qualities much like the last *Glyceria Canadensis*, Rattlesnake grass, is large, grows in wet bogs, and is of some value. *Glyceria elongata*, grows in the same places and of similar value as last two. *Glyceria nervata*, Meadow spear grass—nerved manna grass: (some call it Fowl Meadow grass, and others Drop seed), it does best in low places; is common, nutritive, and valuable in some places, but of less value than Red top. *Festuca ovina*, Sheep's Fescue, is small, almost insignificant, early, sweet, pretty, and grows in tufts. In the Scotch Highlands, at the altitude of 4,000 feet, it constitutes the greater part of sheep pastures. It does very well in the shade and stands dry weather well; there are several varieties, none of which seem to have much merit for this country. *Festuca elatior*, taller Meadow Fescue, sheep's fescue. It thrives in stiff soils, doing very well in shady places. It is nutritious and early, flowering in June or July. Cattle are very fond of it. It produces well in many places. There are several varieties which run into each other. It has been extensively tried in the old country, and much liked by some farmers. Be sure to cut for hay as soon as in flower. *Bromus secalinus,* Cheat or chess, Willard's bromus, in England called lop, too well known in this country as a pernicious weed in wheat fields. A few years ago the seeds were sold as producing fine meadow grass. A jury of cows did not agree with the great puffs it received in the papers. There are two other species, also of foreign birth, of no value. We have two species that are wild, *Bromus Kalmii* and *B. Ciliatus,* which may be worth trying in dry soils. *Phragmites communis*, reed grass. This grows in both hemispheres; twelve feet high in swamps; the tallest grass as far south as Michigan. *Lolium perenne,* Ray or rye grass, common darnel. Introduced from England, where it is one of the most universal grasses in cultivation. It has often been mistaken for Quack grass, but may be distinguished by its single glume, no rhizomes, and spikelet turned edgewise to the axis which supports it. It has a very high reputation for pasture, lawn or meadow. It needs high culture and a moist climate. After a thorough test in some parts of Pennsylvania, it is much liked. It is early, starts quickly after mowing; the leaves are very glossy; excellent for lawns. *Lolium Italicum,* Italian rye grass. This grass needs rich land. Many people have doubtless failed in its culture by not understanding that it is a biennial. For a single season, no doubt, it is one of the best grasses, and is much used in the old country. Cattle like it; it grows fast, is nutritious, early, and fitted for alternate husbandry. *Triticum repens,* Couch grass, Witch grass, Quitch grass, Twitch grass, Chandler grass, Quack grass. This is productive and nutritious, and would be a valuable grass in many soils were it not so difficult to eradicate when it once gets in. It multiplies rapidly by creeping underground stems. A pernicious weed. It is very nearly related to common wheat. *Elymus Virginicus,* Lyme grass, wild rye. It is coarse and not promising unless in dry soils. *Elymus Canadensis,* Canadian lyme grass. Found on lake shores and river banks. Large and showy. We can not tell what it might do with good culture for a series of years. It is worth trying, as well as many others. *Danthoneæ spicata,* Wild oat grass, White top, Old fog. It grows on dry, sterile soil, is early but poor feed. *Avena,* Oats. There are two wild, and some foreign species. They are worthy of attention. *Aria flexuosa,* Hair grass. Slender; found in woods. Sheep are very fond of it, but it is too delicate. There are three other species quite similar. *Trisetum.* There are two natives and several in Europe. The former have not been tried; the foreign prove to be of some value. *Arrhenatherum avenaceum,* Tall oat grass; ray grass of France. It has been tried and extensively recommended in some parts of Pennsylvania. It is early; cattle and sheep will eat it when they are forced to. It is said to be the most abundant of any grass cultivated in France. Starts quickly after mowing, used for soiling. *Holcus lanatus,* Velvet grass, or soft Meadow grass. It stands droughts well, and has given favorable results after a few trials in this country; some praise it, others call it worthless. *Anthoxanthum odoratum,* Sweet-scented vernal grass. Owing to an abundance of benzoic acid, it is very fragrant, and a general favorite with people about haying time. It is small; it is the earliest grass we have, and also grows till very late in the season. Some think that it adds to the quality of butter, but the late Sanford Howard met this assertion by saying, then we should have the best butter in the New England States, where it is the plentiest. This is not the case; cattle do not like it. Good in lawns, will grow on poor land. *Phalaris arundinacea,* Reed canary grass, is the original of the ribbon grass which is cultivated for ornament. It is large and coarse. Grows on wet land; cattle are moderately fond of it. Some think it promising. Produces a large crop, something like Blue Joint. *Panicum* is a very large genus, containing thirty-three species in North America, and four hundred in all the world. *Panicum crus-galli,* Barnyard grass, is an annual, a coarse, large, sprawling, juicy grass from Europe; it has sometimes been cultivated. Varies much; stock eat it. At best a weed, though called ornamental in some parts of Europe. *Panicum geniculatum,* Hungarian grass, which has had a great reputation in some places. A valuable annual grass if cut when in flower. *Setaria viridis,* Bottle grass, green Fox-tail, wild Timothy. A weed in fields and gardens, from Europe, looking like small Millet. *Setaria glauca,* Foxtail grass, much like the last. If allowed to ripen, it is good to spread under a shed for fowls, which like the seed. *Setaria italica,* Bengal grass or Millet. It runs wild where sown, like a weed; does not equal oats as a forage plant. Of the far western grasses, the United States Agricultural Report some years ago gave a list of one hundred and forty-three species, including fifty-seven genera of grasses, found native in the region of country lying west of the Missouri river, known as the high plain region of the United States, between the parallels of 35° and 45° north latitude and embracing the eastern water shed of the Rocky mountains between these parallels, including the States and Territories of Nebraska, Kansas, Colorado, New Mexico and the Indian Territory. Of the species given, ninety-one extend across the Missouri river, leaving fifty-two species belonging to the plain and mountain region proper. The remaining eighty-four species could not be considered as belonging more to this region than to the States east. The relative value of these various species as forage grasses differs very widely, a few of them being entirely worthless, and many of them almost valueless as compared with others. The list of these varieties will be interesting, now that this region is so fast settling up. The largest number of the species could be dispensed with, without manifest disadvantage to the grazing interests of the country. As a rule farmers are slow to try new species of grass, notwithstanding the fact that, among the greater part of our farmers, clover and timothy form not only the bulk of their meadows, but also their pasture as well. Our agricultural colleges would do a good work if they would try new varieties with a view to their introduction if they proved valuable. The relative value of the twelve most important species is exhibited in the following table of per centum estimates, one hundred representing the aggregate value of the twelve:

Species.	Missouri river region.	Rocky mountain region.
	Per ct.	Per ct.
Adropogon furcatus	40	16
Adropogon scoparius	20	10
Sorghum nutans	20	12
Sporobolus heterolepis	12	1
Buchloe dactyloides	5	5
Bouteloua oligostachya	0	10
Spartina cynosuroides	2	2
Festuca ovina	0	20
Festuca macrostachya	0	5
Bromus Kalmii	0	8
Poa serotina	0	8
Stipa viridula	0	6

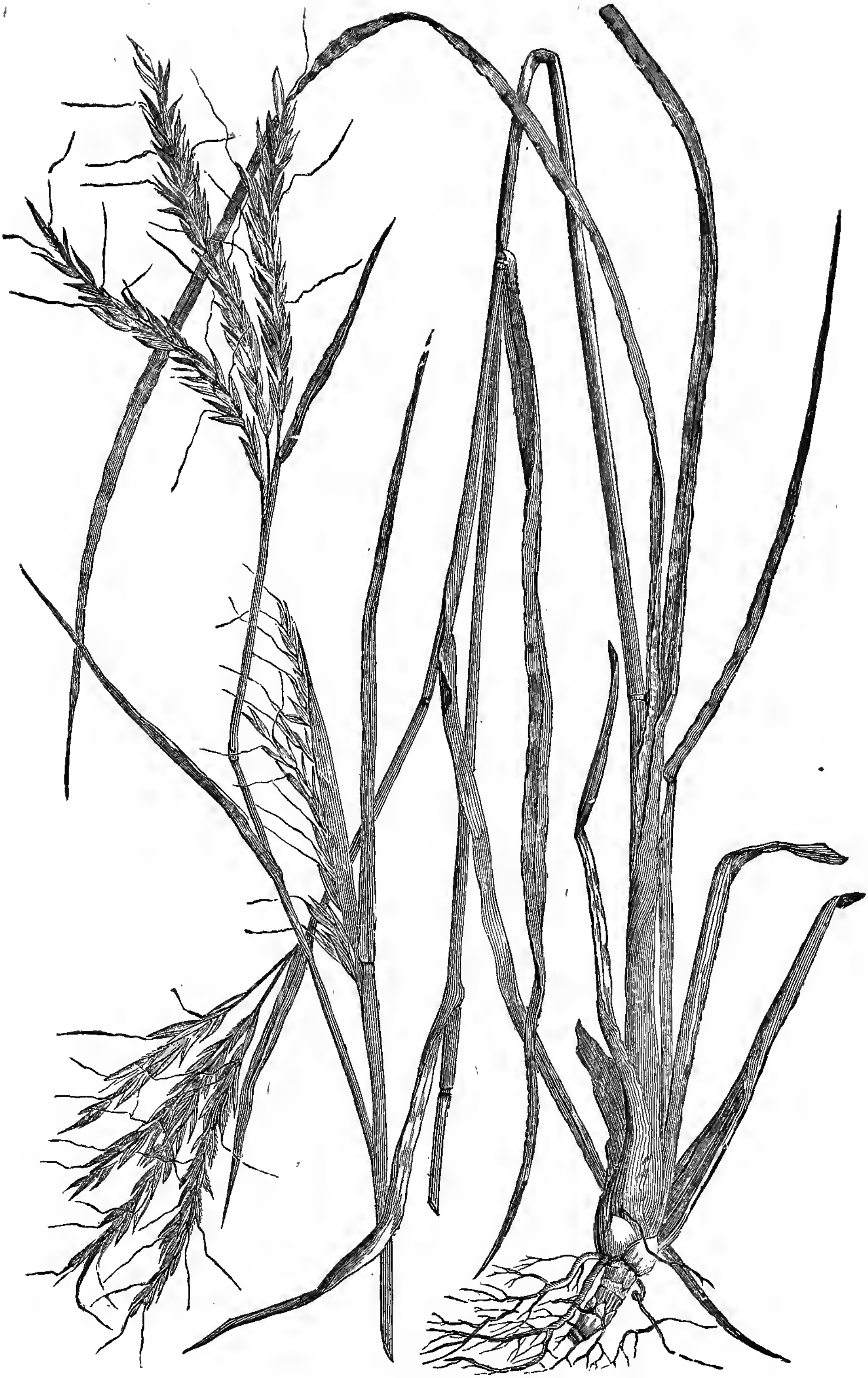
These estimates can only be approximate, of course, but they are believed to be so nearly correct that, as a comparative exhibit of the relative value of the species now comprising the great forage resources of the country, their importance will not be overlooked. The flesh and fat producing qualities of these several species have not yet been sufficiently tested to warrant comparative estimates of their relative value in this respect. *Andropogon furcatus*, *Andropogon scoparius*, and *Sorghum nutans*, by their abundance in all the eastern portions of the district, are the leading species, and at present comprise at least three-fourths of the grazing resources of that portion of the country. Next in importance follows *Sporobolus heterolepis*. This species is peculiarly palatable to cattle, and they are seen roving over rich pasture of other species in search of it. This is also said to be the winter forage species of Kansas, where it abounds, affording the rich winter pasturage of the farmers and herders of that State. It flourishes chiefly on the moister portions of the plains, and many local areas are almost exclusively occupied by it. Many of these far western grasses have yet no common names. These not being given until species are introduced into general cultivation. In the following description of species, descriptive terms that may be readily understood by all, will be used, and from which it is believed the identification will not be difficult to those who do not understand botanical terms. *Andropogon furcatus*. This species, the most abundant over large areas, is distinguished only by its spikes of flowers and fruit from its near relatives, *Andropogon scoparius* and *Sorghum nutans*, with which it often grows. It grows nearly twice as tall as *A. scoparius*, with spikes of flowers longer, and ridged, and two to five together, terminal, and on short branches from the axils of the upper leaves. The spikes are purplish generally, but often entirely destitute of color. It does not fruit every year, nor in all situations. A very favorable season of moisture is required to cause it to fruit abundantly. It is one of the principal hay grasses of the country, and is abundantly cut and cured for winter use. *Andropogon scoparius*, a much smaller plant than the foregoing, and much less abundant, yet apparently quite as valuable for feeding stock. It is known by its numerous slender branches from the axils of all its upper leaves, having its spikes of flowers single and scattered along the branches, very slender and thinly, silky, hairy, and often purplish as the preceding species, and frequently growing with it, and difficult to distinguish from it when not in fruit. This is also one of the hay grasses, and is esteemed of equal value with the foregoing for winter feed. It is singular that these two most valuable western grasses should have been considered remarkably worthless grasses by the learned Dr. Darlington, less than twenty years ago. *Sorghum nutans*. This noble prairie grass is at once known when in flower by its single terminal panicle of sorghum-like spikelets drooping in mature fruit, shining with brownish or russet hairs. This plant has often a peculiar glaucous hue, forming a striking contrast when growing with the form destitute of the glaucous bloom. In many localities it is scarcely less abundant than *Andropogon furcatus*, and constitutes a large portion of the prairie hay. Like the two previously described, it fruits only in favorable seasons, and in the growth of foliage is also much diminished by dry summers. The hay from these three species is considered best when cut just before killing frosts in early autumn. *Sporobolus heterolepis*. This species may be identified by its long, slender leaves, growing abundantly from the base of the plant, gracefully curling and frequently resting their tips on the ground; from its tendency to grow branches or stools, and, when in fruit, from its small panicle of sharp-pointed spikelets and its round seeds. These, when bruised, emit a strong, heavy odor, which has been compared to that of *Eragrostis megastachya* when crushed in the hands; but to most persons it is much less offensive, and to some not at all disagreeable. It attains to the average height of about two and one-half feet in fruit, but in dry seasons large tracts almost exclusively composed of this species are without a single fruiting plant. It is sometimes cut for hay, in the absence of the more productive species, and makes an article of first quality. *Buchloe dactyloides*. This is the noted buffalo grass of the region, and may be recognized at once, and be distinguished from all other species, by its low, dense, tufted growth; also by its stolons, from which it spreads rapidly. It seldom if ever attains to the height of over two or three inches, except with its male flower stalks, which sometimes reach two or three inches above the leaf growth. These have at their summit a few flat spikes of male flowers only. The female flowers are clustered down close to the earth, and nearly covered with tufted leaves Male and female flowers are borne by the same plants, not by different plants, as was at one time supposed. It grows most abundantly in the central region of the plains, and affords nutritious, but rather scanty grazing for domestic animals; yet its value as a winter forage plant is not to be overlooked, as its stolons remain green during the winter months, and, combined with the dead leaves, afford to closely grazing animals a reasonably good living. In southern Kansas, the plant reaches its eastern limits, about one hundred miles west of Fort Scott. There it first appears in small, distinctly outlined patches, a few feet in diameter, and in narrow strips or lines at the base of low elevations on the large prairies. We were puzzled to understand how this humble plant was holding its place, here in the midst of strong, tall, growing competitors, *Andropogon* and *Sorghum*, surrounding it closely, but not venturing on an inch of its territory; but we soon succeeded in discovering that the phenomenon resulted from local soil conditions. At the depth of half an inch below the surface of those areas, the soil, for an inch or more downward is closely compacted and hardened, so as to prevent the roots of plants from penetrating through it. These areas, being thus unfitted for the growth of deep-rooting plants, had become open for settlement by this humble species, which requires only a shallow soil to sustain it. This hardened condition of soil at the base of these low elevations, is evidently from the agency of alkali, or some related mineral substance, filtering through the soil and cropping out at these places. Not having tested the conditions under which the plant exists in the heart of the plains—the center of its home—we are unable to say whether similar phenomena attend it there; but that an alkaline saturated or tinctured soil is essential to its growth has been disproved by the cultivation of the plant east of the Mississippi, where it flourished finely, but it is unable to compete with its intruding neighbors, and is soon overrun and destroyed. As an instance showing its tenacity of life, we record the fact of its having stood the treading of animals in a farmer's feed lot, where every other green thing had been destroyed. Whether it can be turned to any profitable account in the agriculture of the country remains for future experiment to determine. *Monroa squarrosa.* This comparatively worthless species somewhat resembles the buffalo grass in habit and mode of growth, and might be taken for it by those unacquainted with the latter species, the fascicled and tufted leaves of its prostrate branches resembling the stolons of Buchloe. The plant is an annual, with rigid and rather large foliage, and bears its fruit almost entirely concealed in the sheaths of its numerous leaves. It is rather common in the mountain districts and on the Upper Missouri, but abounds on the richer soils eastward. *Bouteloua oligostachya.* This is one of the principal grama grasses of the plains and mountains, but this common name by no means applies to the species or to the several species of the genus exclusively, but is given by the mountain men to several other species of different genera. It is a most valuable species for grazing purposes but grows too thinly, and too short to be cut for hay. It abounds chiefly in the mountain regions and the adjacent plain districts, and may be readily distinguished from species of other genera by its peculiar spikelets of flowers all arranged on one side of the rachis, and pointing in one direction. It supports on its stalk from one to three or four, and sometimes five of these spikes, which are purplish, or of an indigo-blue tinge. Its general height is about twelve inches, but in sterile locations much less. The leaves and stems are smooth, having no hairs. It is perennial. Much of the beef of the southwest is claimed to be the product of this grass; *Bouteloua hirsuta.* This less valuable species so much resembles the foregoing that some care and close observation are necessary to discriminate between them. The spikes of flowers are shorter, and more curved when mature, and present a bristly appearance, from the numerous rigid hairs that grow from the conspicuous dark glands of the glumes. The leaves and stalks are also hairy. It generally grows shorter and prefers more sterile situations, where sand and gravel abound. It is not a perfect perennial, but appears to be a biennial; or something like a winter annual. It is not esteemed as a forage plant. *Bouteloua curtipendula.* This beautiful species is at once distinguished from the other by its long, slender raceme of numerous (twenty to fifty, or more) spikes. These are small horizontally bent or reflexed and sometime, but not always, purplish. It grows two to three feet high, is perennial, but the foliage is scanty, and as a forage plant is not highly valued. It abounds in many localities in the plains and mountains. *Spartina cynosuroides.* The fresh water cord-grass of the whole country abounds also in suitable situations there, and, as in the States east of Missouri, is frequently cut for hay, but it makes only a miserable substitute for that article. No animal will eat it until driven by a degree of hunger approaching starvation. It is to be regretted that this abominable fare is still provided for the faithful beasts that contribute so much to the wealth and happiness of man. The western cities and towns continue to store it largely for feed for horses, simply for the reason that it may be easily obtained, or is cheap—to the exclusion of the nutritious and savory *Andropogon, Sorghum*, and *Sporobolus*—which merciless, mercenary practice can not be too strongly condemned. *Festuca ovina.* In the mountain regions, and adjacent plains this species is plentiful, and contributes largely to the general forage crop of the country. It is esteemed a nutritious grass, notwithstanding the hard, wire-like appearance of its leaves and culms. The species is variable, and includes very different forms, arising in part from the conditions of locations. It attains to the height of about two feet, in favorable situations, and grows chiefly in bunches or stools, with erect, straight, stiff culms, long, narrow leaves, of pale green color, and has numerous flat spikes of flowers in a small panicle, often purplish. The several varieties or forms of this, sheep's fescue, grass possess very different constitutional qualities as to naturalization tendencies, some forms being so sensitive to changed conditions, that they can not be made to survive artificial treatment. *Festuca macrostachya.* A valuable mountain annual species in the mountains of New Mexico, of very variable forms. It is one of the grama grasses of that region, from six to eighteen inches high, with a loose, lax panicle of small spikelets, bristle pointed. *Bromus Kalmii.* Chiefly found in the mountain districts. A slender tall growing grass with a graceful panicle of drooping or nodding spikes of flowers. These are long and roundish, or flat when mature; where plentiful it affords excellent pasturage. *Stipa viridula.* From four to six feet high in favorable situations, with a plentiful supply of large flat leaves. A considerable amount of mountain grazing comes from this species. *Poa serotina*, and the other species enumerated in the catalogue, abound plentifully in the high as well as the low districts of the mountains, and are all rich, nutritious grasses, and, where abundant, afford valuable food for all kinds of stock. *Triticum caninum repens* and *œilopoides* contribute largely to the pasturage of some districts, and are not deemed so valueless as in the East, and, with a few other species in particular localities, are the chief reliance for grazing animals in those neighborhoods. The *Cyperaceæ*, sedge grasses, are largely consumed by stock, and are even made into hay where abundant. The large family of *Carex* afford the best species. Though less nutritious and palatable than most of the true graminaceous plants, they are highly valued and largely used in some mountain districts. *Carex gayana*, in the mountain valleys and intervales of Colorado, affords the principal hay of the country, but many other species are used for both hay and pasturage. The relative value of the several species depends more on quantity than quality, excluding a few of the coarse aquatic kinds that are quite worthless. The comparatively few species above described embrace the chief grazing resources of the region under consideration, and these resources are conceded by every one to be the principal source of the wealth of the country. The early pioneer, however, has already learned how soon the native grasses are destroyed by the cropping and treading of domestic animals, and he sees with regret their places taken by worthless weeds and grasses that occupy the soil to the exclusion of every profitable production. He sees that, as settlement progresses and domestic animals increase, the natural pastures diminish; he recognizes the inevitable destiny of the grass product, which is the principal resource of his country, unless it can be supplied by cultivated species, and he naturally turns his attention and directs his labors to this task. The test of the experiment alone is to demonstrate the practicability of his work. The settler finds the climate peculiar and extreme; not uniform in its several seasons, yet possessing extreme general characteristics to which he must conform his operations to be successful. Knowing that the greatest wealth of a nation springs indirectly from its agriculture, and that the latter is completely successful only when it adapts itself to existing conditions; that no conquest over nature pays the cost of the warfare with its spoils, and that a persistent antagonism is not profitable to any people; and being without a successful precedent under similar climate and soil conditions in this country, original experiments must form the basis of operations. The test of species by sowing their seeds in plowed land and leaving them without further assistance to establish and defend themselves against the encroachments of native and naturalized foreign worthless weeds and grasses should be the plan of experiment; for, however well a species might succeed in a strong contest with competitors, it can not be profitable as a cultivated grass. From the peculiar character of American climate and soil, or the very unequal powers of our grasses for territorial conquest, we expect to find but one, or, at most, but few species adapted to any locality or situation. We are told that twenty-two species have been counted on a square foot in a rich, old pasture in England. Such a result on the plains is utterly impossible. Monopoly seems the law of those species, and only local conditions arrest the domination of the strong, and this for the reason that only species resisting drought can live. It is natural that we should expect to find in some native species of the plains or mountains the successful plant or plants already adapted to the peculiar climatic conditions of the country, but we must remember that soil conditions have also very much to do with the growth of plants, and that settlement and cultivation greatly change the conditions of the soils of any country. With these facts before us, our experimental operations may be more intelligently pursued. The plant required is one that will do for the coarse, open, and arid soil of the plains, which is often dry for a long time, what Blue grass (*Poa pratensis*) has done and is doing for the States east of the Missouri river within the same parallels, one that will not only maintain its footing but will extend its area and overcome competitors as Blue grass has done in several of the States east, and which now forms the best pasture lands in the Union, monopolizing the entire soil product on thousands of acres. This species, however, being adapted only to finely comminuted soils and moist during the period of its growth, does not succeed satisfactorily, though in some localities on the eastern confines of the district it maintains a feeble existence. A strong-growing, coarse perennial, with rhizomes, or underground root-stalks, would suggest itself as a suitable species for trial, or a perennial producing an abundance of radical leaves, and of early growth, that would cover the soil and prevent the growth of annuals. Of this class we suggest the following for experiment: *Elymus Canadensis.* A native over a large area of North America; has been cultivated in Europe, but was soon discarded on account of its coarse character as compared with the pasture and hay grasses of that country. *Elymus Virginicus.* A hardy species of early growth, producing an abundance of large, succulent leaves when young; a widely-distributed species in America. Cultivation greatly accelerates its growth. It is a promising species. *Elymus Sibericus.* Native of Europe and America, in the colder latitudes; would probably succeed well in the northern districts, where it is native. *Elymus mollis.* Grows early and spreads rapidly by its running root-stalks; foliage, when young, tender and juicy. It thrives well in a variety of situations different from its habitats (sandy shores); probably not adapted to a dry soil, but well worthy of trial; leaves broad, rather short, with a beautiful glaucous hue and strong *Triticum* flavor. *Sporobolus heterolepis.* A most valuable native species; should be tried in cultivation for hay, but for pastures would doubtless soon be trod out by animals. Fields of this species, and *Andropogon furcatus*, *A. scoparias*, and *Sorghum nutans*, inclosed from stock, and mowed only after full maturity in autumn, would long remain good natural meadows, and this plan will probably be adopted until the lands advance so much in value that the hay produced alone will cease to be a paying crop. *Ceratochloa grandiflora.* This species inhabits the mountain districts, and has a wide range, reaching the Pacific in some of its forms. It is a large species, growing three feet high, often more in good soils; not a coarse species for its size. Generically, this species is nearly related to *Bromus*, and much resembles *Bromus Kalmii*, but has much larger and broader spikes, not drooping as in that species. From its habit of growing a mass of radical leaves early in its season, preventing the growth of intruding annuals, it maintains its place in localities where there is strong native competition, and even extends its areas by means of its seeds. It is inclined to fall in storms, in rich soil, when in fruit. It should probably be cut for hay before the seed matures, unless the practice should be found to injure the vitality of the root. This species merits thorough trial in all localities. In mountain districts *Poa nemoralis* and *Poa serotina* may prove profitable pasture grasses; both are natives of the region, and worthy of trial in cultivation. *Agrostis vulgaris* is a hardy species, tenacious of life, native of Europe and America, found in wet lands, but will thrive in dry, close soils. It may prove profitable in some localities for pasturage. Of foreign species, perhaps the most promising is *Festuca pratensis*, similar to *Ceratochloa grandiflora*. This species grows an abundance of radical leaves, which retain their vitality through the autumn and into the early winter, and in the southern districts would probably remain green through the year. This is a large tall-growing species, and not a very coarse grass. It is a native of Europe and is there esteemed as a valuable hay and pasture grass. It has been introduced into this country, and cultivated in some localities. *Lolium perenne*, an Asiatic and European species, is esteemed as a pasture grass in some parts of the country, and merits trial. *Phleum pratense* (Timothy) will of course be tested thoroughly, but it is believed to succeed very indifferently throughout the whole extent of this region, on account of the open, light, porous soil not affording its roots the protection necessary to keep the plant from perishing during the summer droughts. Following we give illustrations and descriptions of some of the less known northern and southern grasses, and including some but lately described. The figures and description are as follows: *Agrostis exarata*, mountain Red-top. This may be called Mountain or Northern Red-top. Found in Dunn county, Wis., where the grass is a native of the low grounds. It is more slender in its growth than the common cultivated Redtop (*Agrostis vulgaris*). It is a native of the Rocky mountain region; on the Pacific slope presenting a good deal of variety in form and size, so much so that it has received several specific names, although more extended observations are needed to establish accurately the boundaries of the species. There is thought to be little doubt that this grass would be suited to growth in the northern portions of our country, and on moist meadows and bottom lands would probably prove valuable. *Andropogon scoparius*, Broom grass, Broom sedge. A perennial grass, with tough, wiry stems, growiug two to three feet high, with the narrow flower spikes coming out from the side joints, and also at the top. The spikelets are in pairs, on each joint of the slender axis, one of the flowers is sterile and fringed with soft spreading hairs, the other perfect, and with a small twisted awn. It grows mostly in dry, sterile soil—a great eye-sore if it takes possession of meadows, but a good pasture grass before it shoots up its culms, after which stock will touch it no more. Mr. C. Mohr, of Mobile, says of it: One of our most common grasses, covering old fields and fencerows, and extensively growing in the dry, sandy soil of the pine woods. Much despised as this grass is as a troublesome, unsightly weed, it has its good qualities which entitle it to a more charitable consideration. In the dry, pine woods it contributes, while green and tender, a large share to the sustenance of stock. *Andropogon furcatus*, *Andropogon Virginicus* and *Andropogon macrourus* are other species of this genus, which have similar characters with the preceding. In the great prairie region of the West these form an important quantity of the native grasses. Although useful as a resource for stock having a range over uncultivated fields or grounds, their place should, as early as possible, be filled with more valuable grass. *Bromus unioloides*, Schrader's grass, Rescue grass. This is one of the so-called winter grasses; that is, to the Chess or Cheat family. In its early growth it spreads and produces a large amount of leaves; early in the spring it sends up its flower stalks, which grow about three feet high, with a rather large, open spreading panicle, the ends of the branchlets bearing the large flattened spikelets, which, when mature, hang gracefully upon their stems, giving them quite an ornamental appearance. It is not adapted to use in a country with severe winters, and hence did not give satisfaction in all places. Mr. C. Mohr, of Mobile, says of it: Only of late years found spreading in different parts of this State; makes its appearance in February, grows in tufts, its numerous leafy stems growing from two to three feet high; it ripens the seed in May; affords in the earlier months of spring a much-relished nutritious food, as well as a good hay. *Cynodon dactylon*, Bermuda grass, Wire grass. A low, creeping perennial grass, with abundant short leaves at the base, sparingly sending up slender, nearly leafless flower stalks, with three to five slender, diverging spikes at the summit. The flowers are arranged in a close row along one side of these spikes. The spikelets are one-flowered, with a short, pedicelled rudiment of a second flower. The glumes are pointed; but without awns; the lower palet boatshaped. This grass is a native of Europe, and is abundantly naturalized in many other countries. It is said to be a common pasture grass in the West Indies. In the Southern States it has long been the chief reliance for pasture, and has been extravagantly praised by some, and cursed by others, who find it difficult to eradicate it when once established. Mr. C. Mohr says: It thrives in the arid, barren drift sands of the sea shore, covering them by its long, creeping stems, whose deeply penetrating roots impart firmness to a soil which else would remain devoid of vegetation. It is esteemed one of the most valuable of our grasses, either in the pasture or cured as hay. Col. T. C. Howard, of Georgia, says: The desideratum to the South is a grass that is perennial, nutritious, and adapted to the climate. While we have grasses and forage plants that do well when nursed, we have few that live and thrive here as in their native habitat. The Bermuda and Crab grasses are at home in the South. They are not only live, but live in spite of neglect, and when petted and encouraged they make such grateful returns as astonish the benefactor. It seems that it rarely ripens any seed, and the usual method of reproducing it is to chop up the roots with a cutting knife, sow them broadcast, and plow under shallow. Colonel Lane says: Upon any ordinary upland I have found no difficulty by close cultivation in cotton for two years. It requires a few extra plowings to get this sod thoroughly broken to pieces. Prof. Killebrew writes: In Louisiana, Texas, and in the South generally, it is, and has been, the chief reliance for pasture for a long time, and the immense herds of cattle on the southern prairies subsist principally on this food. It revels on sandy soils, and has been grown extensively on the sandy hills of Virginia and North and South Carolina. It is used extensively on the southern rivers to hold the levees and the embankments of the roads. It will throw its runners over a rock six feet across, and soon hide it from view, or it will run down the deepest gulley and stop its washing. Hogs thrive upon its succulent roots, and horses and cattle upon its foliage. It has the capacity to withstand any amount of heat and drought, and months that are so dry as to check the growth of Blue-grass will only make the Bermuda greener and more thrifty, as has often been seen. *Dactyloctenium Ægyptiacum*, Crow-foot grass. This is an annual grass somewhat resembling *Eleusine*, but coarser and stiffer, and of less value. The stems are often rooting at the base, with commonly four acutely pointed stiff spikes at the top of the culm, which are shorter than those of the *Eleusine Indica*. It occurs abundantly in some localities in waste or neglected grounds. The cuts illustrating the more important of these grasses are shown elsewhere. *Eleusine Indica*, Crow-foot, Yard grass, Dog's-tail. This is an annual grass belonging to tropical countries, but now naturalized in most temperate climates. In the Southern States it is found in every dooryard and in all waste places. It does not seem to be very highly recommended for cultivation in the South, although it is said to form good and lasting picking for stock. *Hierochloa borealis*, Vanilla or Seneca grass. This is a grass of northern latitudes, growing in moist meadows near the coast, also in low marshy ground in some parts of Illinois and other States bordering the great lakes, and in the mountains of Colorado and northward. The name *Hierochloa* means sacred grass, so-called because this, among other sweet scented grasses, was strewn before the church doors on Saints' days in the north of Europe. The culms grow from one to two feet high, with short, lanceolate leaves, and an open pyramidal panicle, from two to five inches long. The flowers all with two palets; the two lower flowers staminate only, often around the middle of the back, or near the tip; the uppermost one perfect, short pediceled, scarcely so long as the others and awnless. The spikelets are chestnut colored and rather ornamental. Experiments are wanting to determine the value of this grass in cultivation. *Leptochloa mucronata*, Feather grass. An annual grass, growing from two to three feet high, the flowers arranged on numerous slender spikes in a long panicled raceme. The flowers are minute, three to four in a spikelet, the uppermost one imperfect; the glumes pointed and about equaling the awnless flowers. This is a handsome grass when full grown, the panicles on thrifty specimens sometimes becoming two feet long, the slender branches arranged along the main stem in a feather-like manner, hence the name. Prof. Killebrew says that it grows in fields and pastures and affords a small amount of grazing during the hot months, while the regular pasture grasses are parched up with heat. But it is of no agricultural value in the presence of so many others that are successfully grown. *Muhlenbergia diffusa*, Drop-seed, Nimble Will. This is a low grass, with much-branched stems and narrow, slender panicles of flowers. The spikelets are one-flowered, with very minute glumes, and the lower palet with an awn or beard once or twice its own length. It is a perennial grass, flowering in August and September. Prof. Killebrew, of Tennessee, says: It is hardly more than necessary to mention this grass, which forms, in many sections, the bulk of the pastures of the woods. It does not grow in fields but in woods, where, after rains have set in, it carpets the earth with living green. Various opinions are entertained as to its nutritive qualities. Some farmers contend that their stock are fond of it, and, on sufficient range, cattle, horses and sheep, will go into the winter sleek and fat from this vigorous grass; others regard it as well-nigh worthless. It is said to be an excellent butter-making grass, giving it a particularly fine flavor. *Paspalum læva*, Water grass. There are a number of species of this genus which in general appearance are hardly distinguishable. In the structure of the flowers they are very near to Panicum, from which they chiefly differ in the want of a lower glume. Mr. D. L. Phares, of Mississippi, says of this grass: It is not called water grass because it grows in and about water, for it does not, but probably because it is very succulent. It is troublesome in crops; live stock are very fond of it in all stages of growth and as dry hay. A neighbor has a meadow of it from which he mows every summer about two tons of hay per acre. It is very easy to set land with it; that is, it catches readily. *Panicum crus-galli*, Barnyard grass, Cock's-foot grass. Of this grass Mr. Mohr says: An annual, two to three feet high, bearing its roughly-awned flowers in dense, one-sided panicles composed of numerous crowded spikes; it grows luxuriantly, particularly in the low lands of the coast, is greedily eaten by horses and cattle, and makes a hay of good quality. It is justly regarded as an excellent grass, particularly before it ripens its seed, as in the later stages of its growth the long and stiff awns of its spikes tend to make it somewhat unpalatable. Mr. D. L. Phares, of Mississippi, says of this grass: The hay is very highly esteemed by many farmers. In northern Mississippi I have seen large fields of it mowed. This grass should be cut early, while it is juicy and palatable. This will be at the first appearance of the flowers or soon thereafter. *Panicum filiforme*, Slender Crab grass. This is a native species of southern Crab grass. It is annual, growing with erect, slender culms, which are terminated by three to five slender, erect spikes of flowers. The leaves are one to two inches long, smooth below, sometimes a little hairy above, the lower sheaths hairy. It grows mostly in dry, sandy soil and is of little value, from its scanty foliage and thin, wiry stems. *Panicum jumentorum*, Guinea grass. This is a perennial grass of strong, vigorous growth, a native of Africa, extensively cultivated throughout the tropics. Mr. Charles Mohr, of Mobile, says: It is planted with us in the beginning of April; admits the first cutting during the last week of May; it makes very large bunches and is to be cut before extending to the height of about eighteen inches. In that stage it is very sweet, tender, and easily cured as hay. In moderately fertilized land and favorable seasons



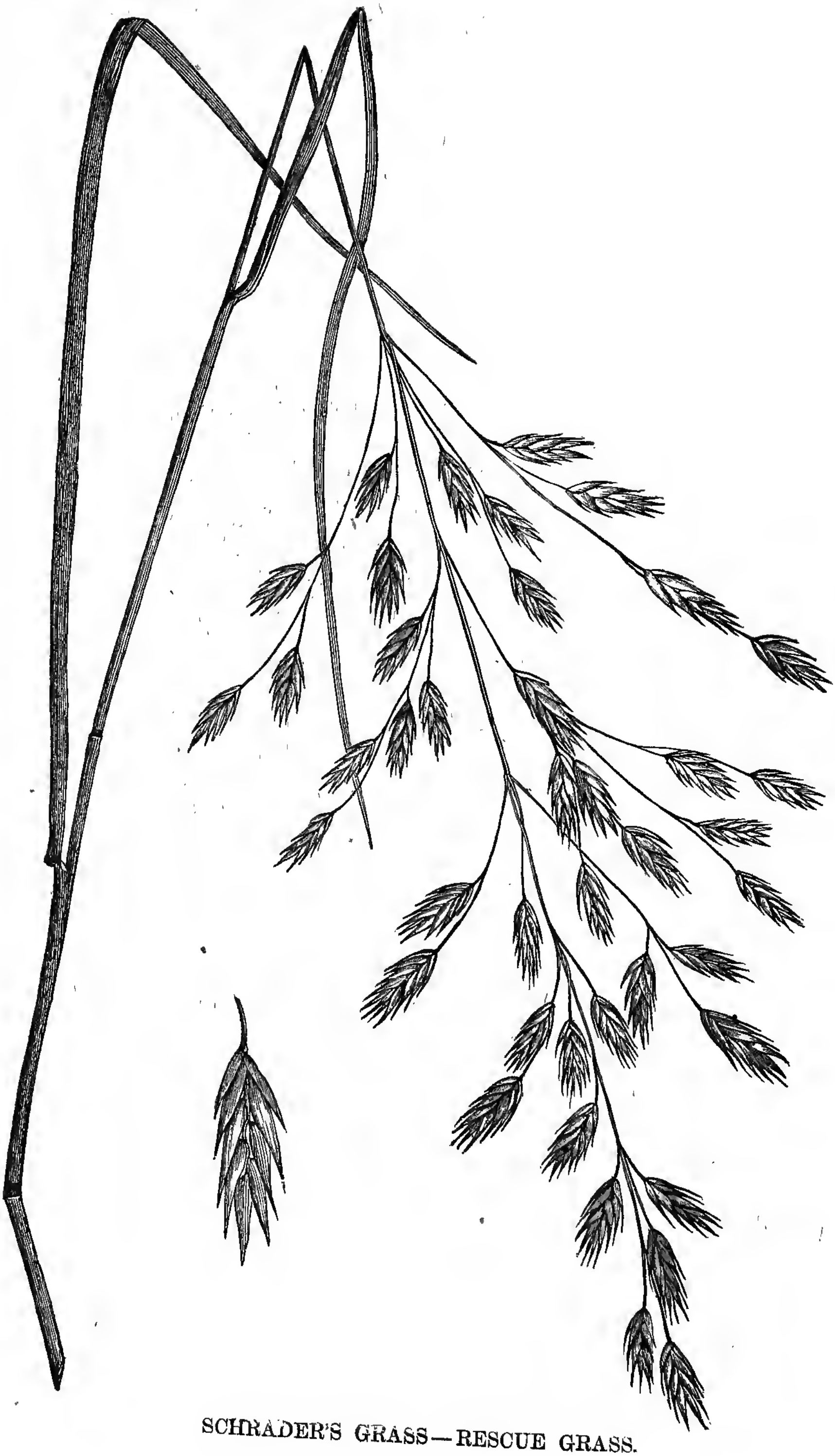
MOUNTAIN RED TOP—NORTHERN RED TOP.



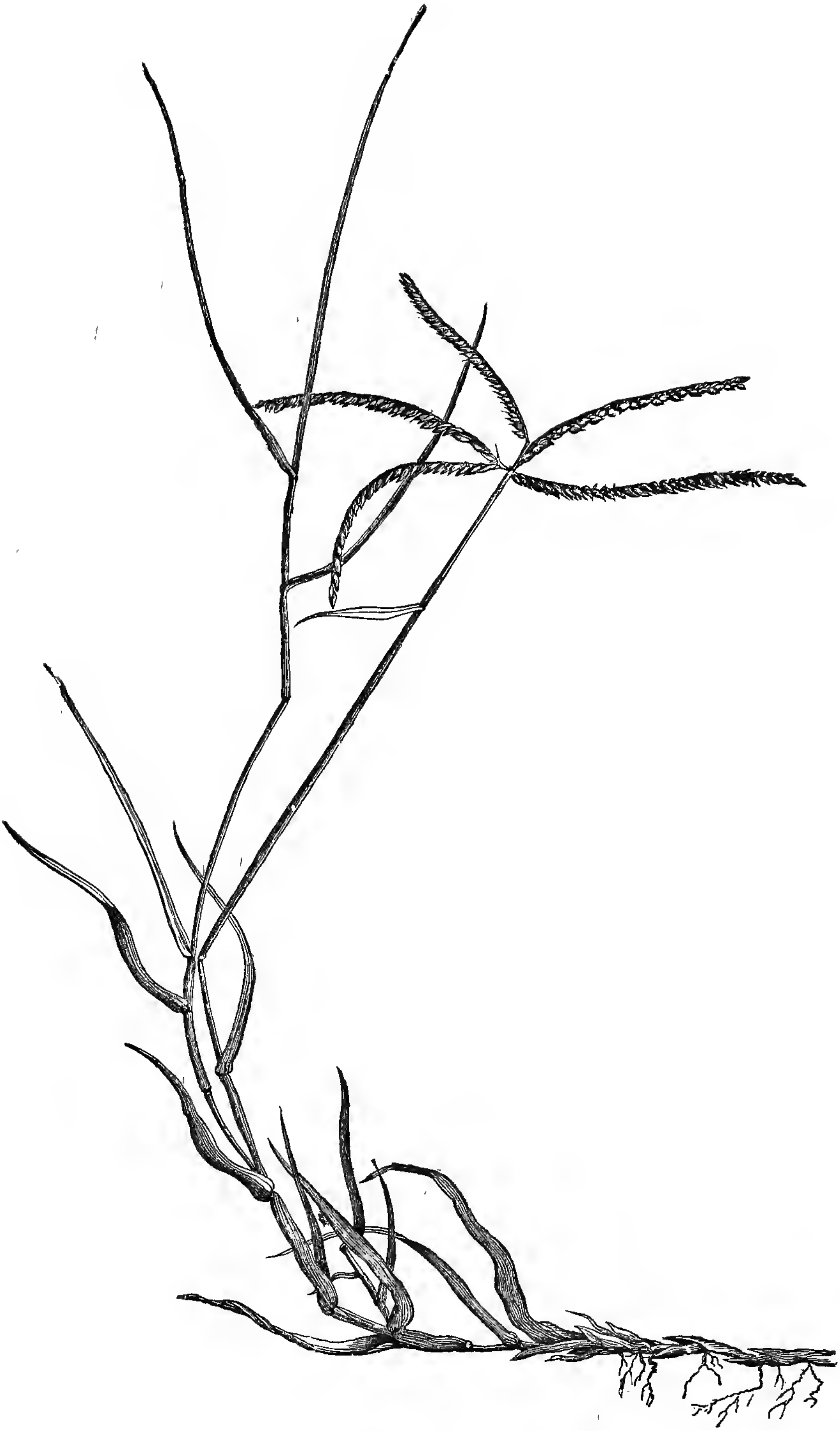
BROOM GRASS--BROOM SEDGE.



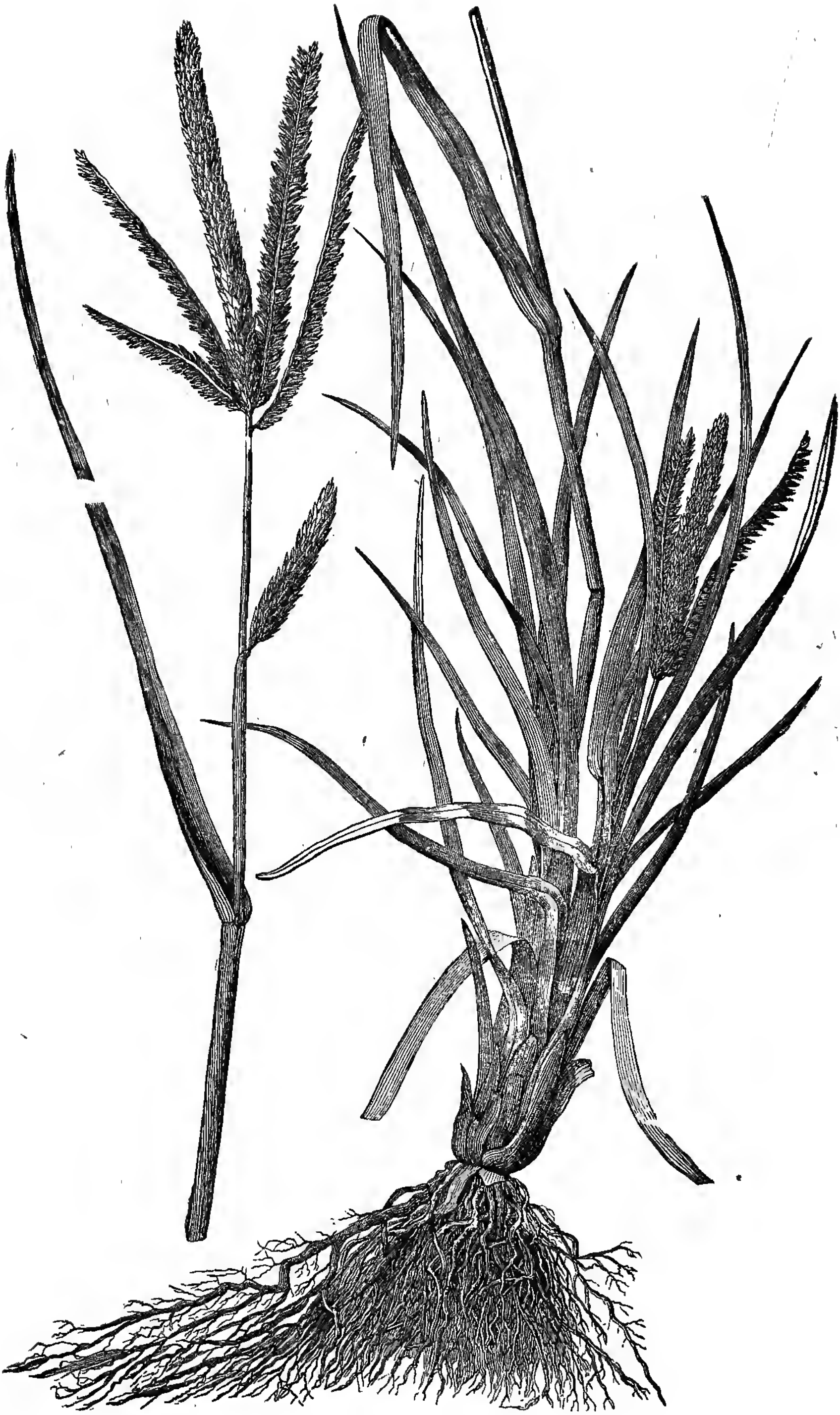
BROOM GRASS—ANDROPOGON FURCATUS.



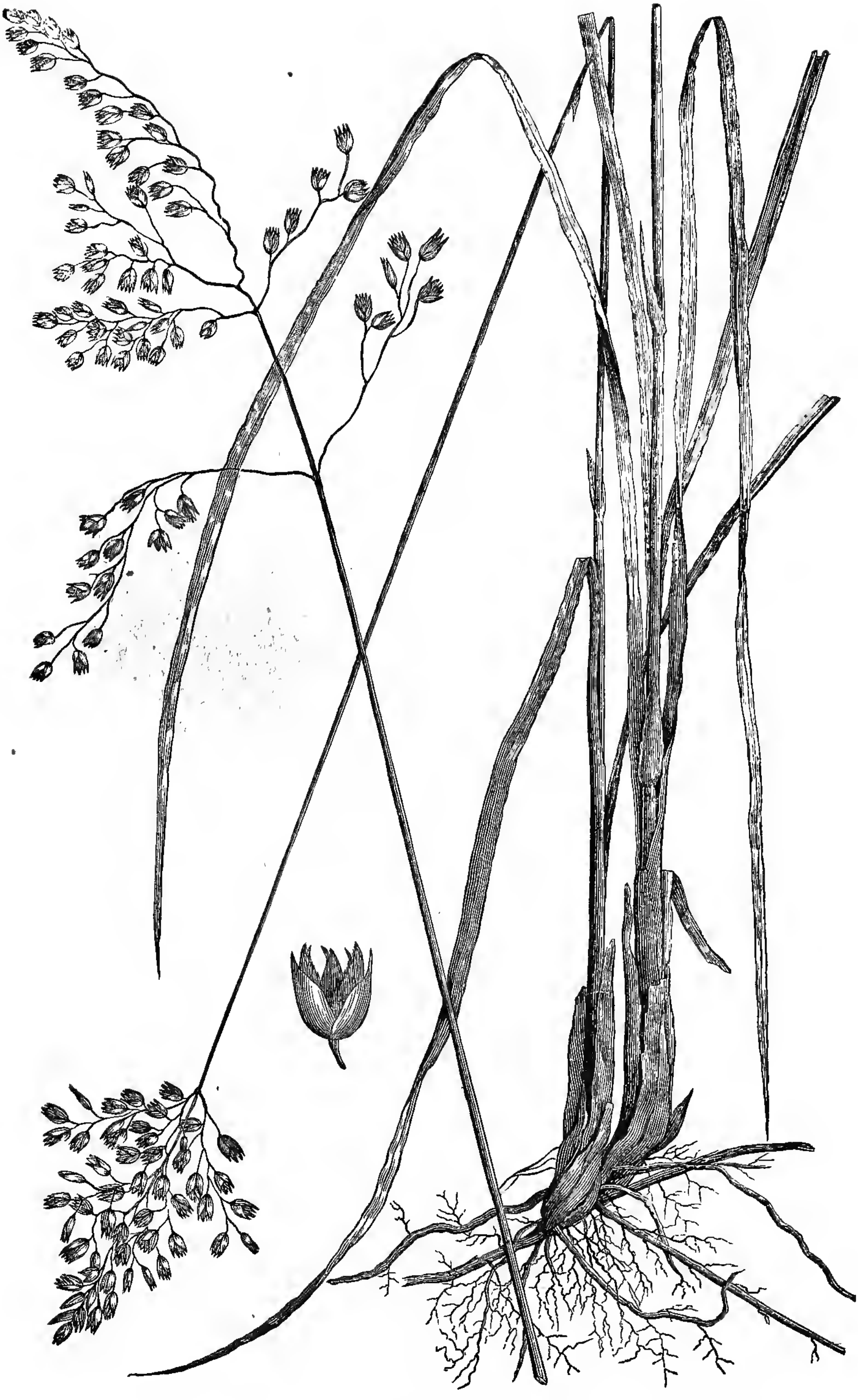
SCHRADER'S GRASS—RESCUE GRASS.



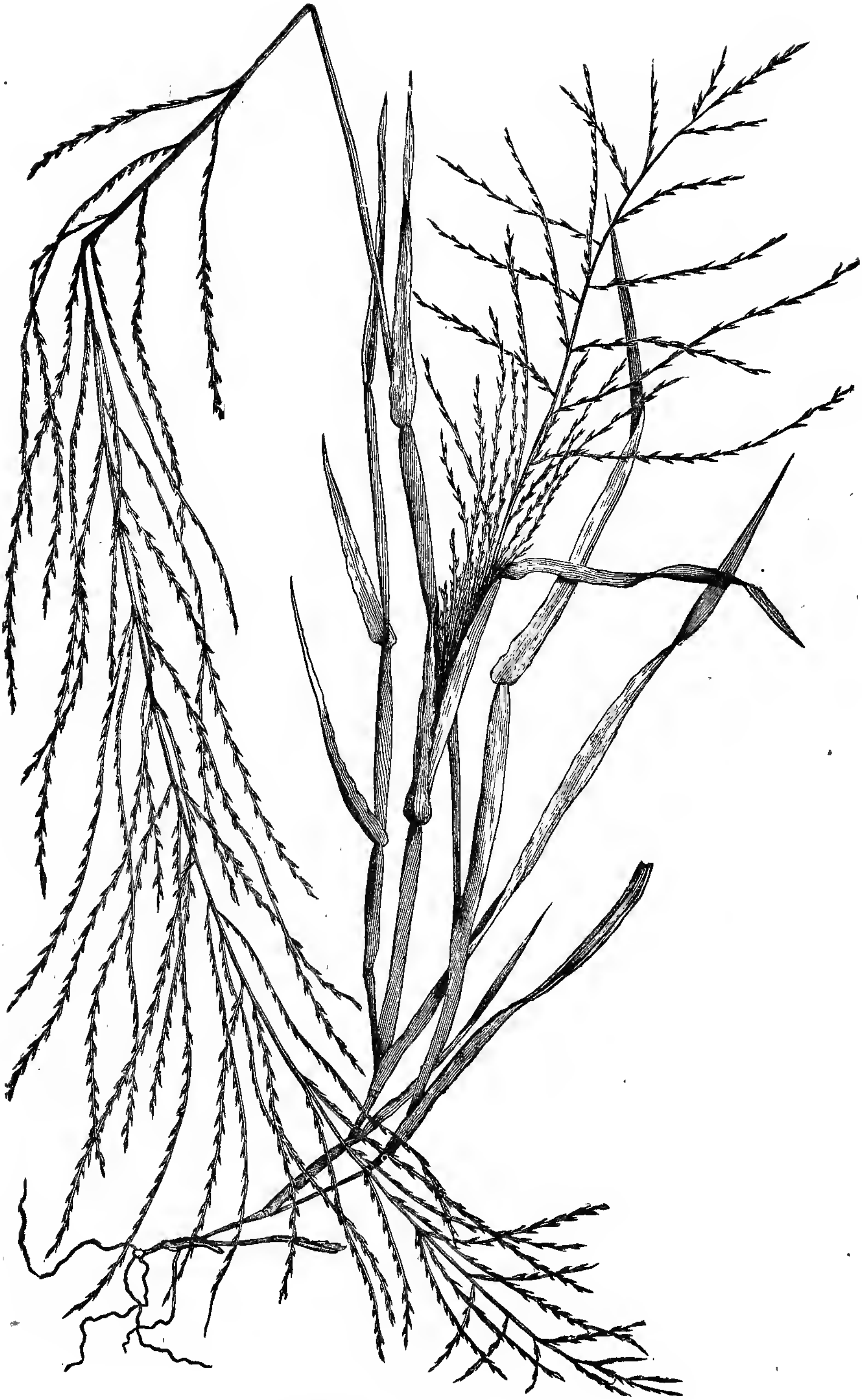
BERMUDA GRASS—WIRE GRASS.



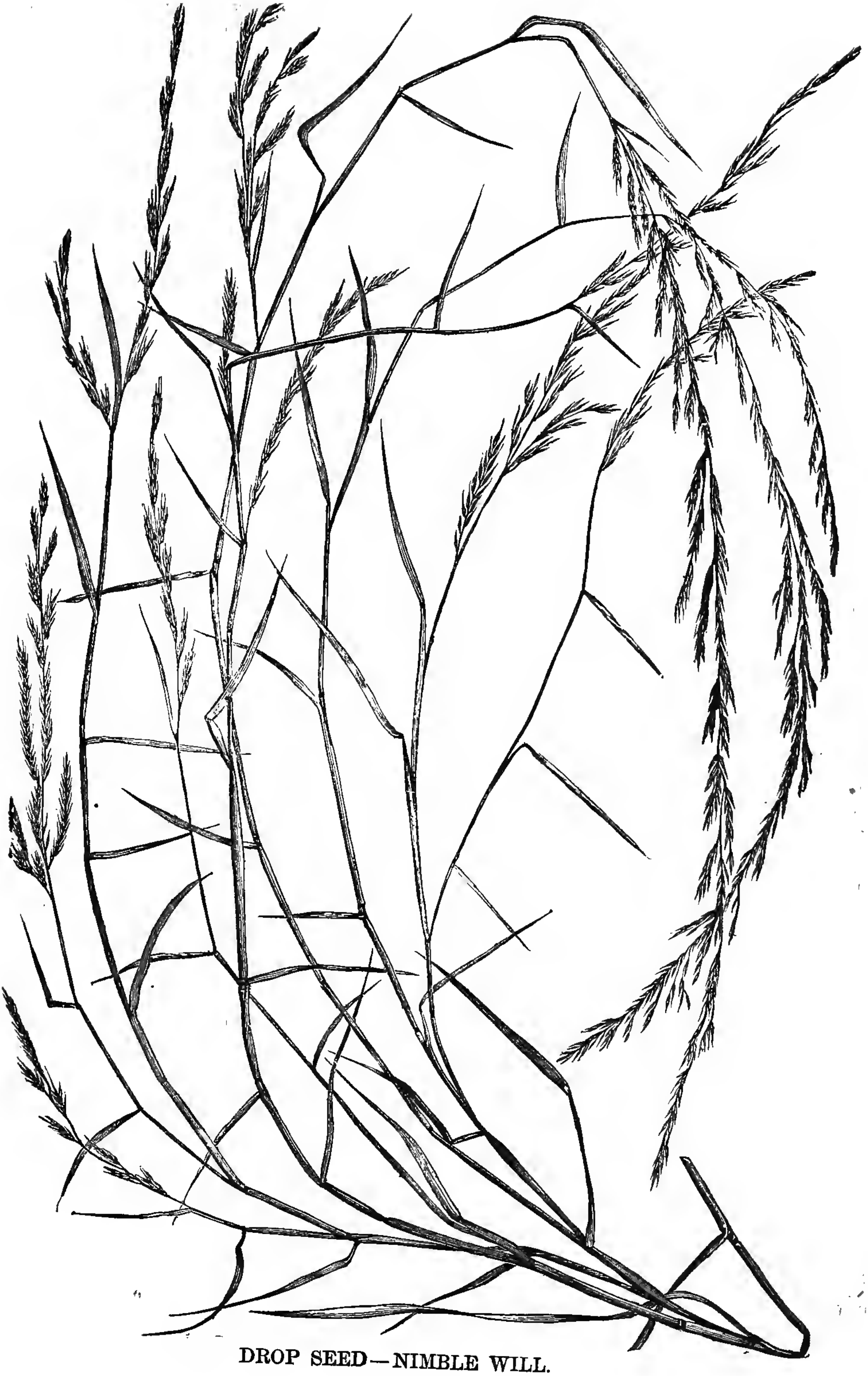
CROW FOOT—YARD GRASS—DOG'S TAIL.



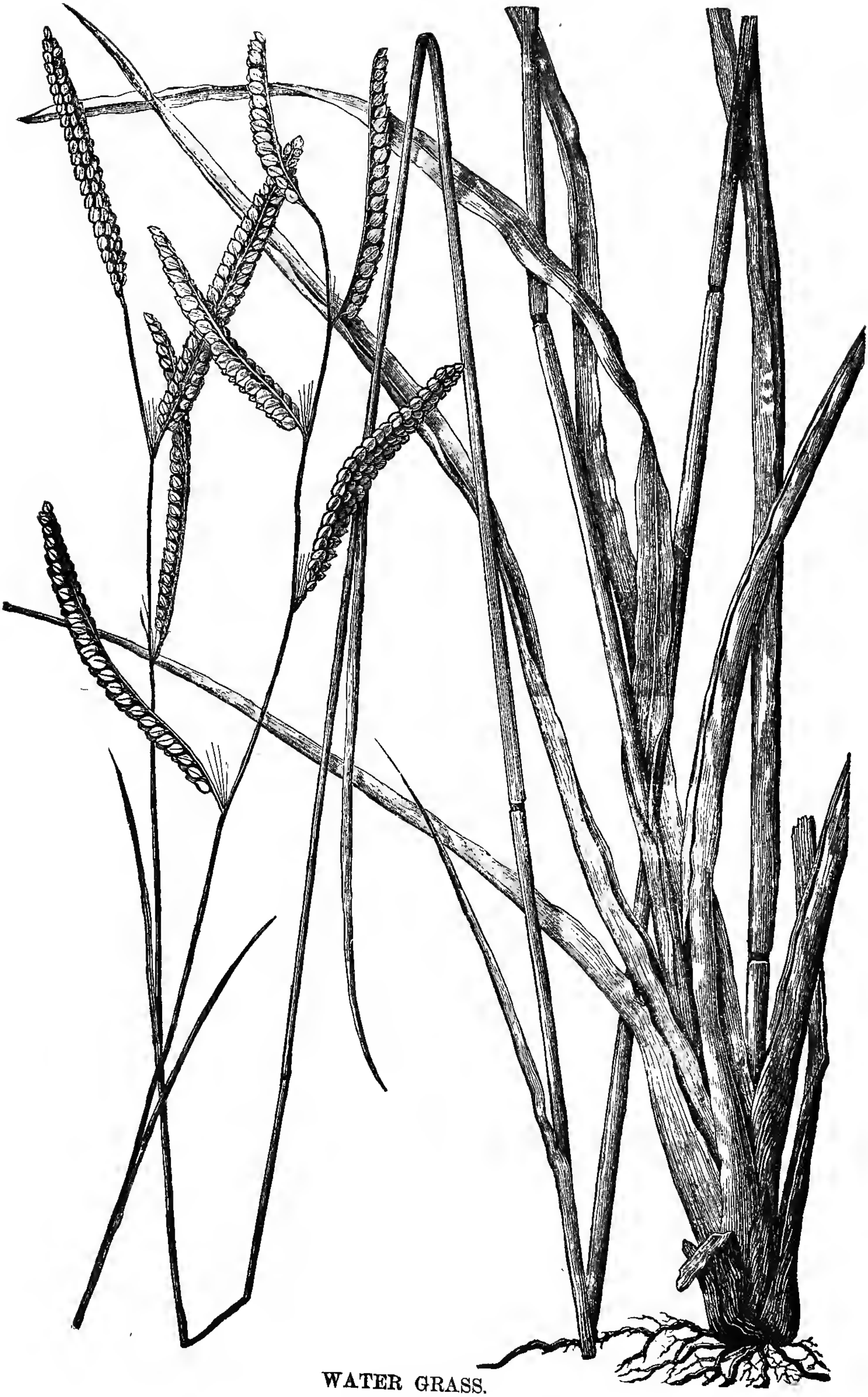
VANILLA GRASS—SENECA GRASS.



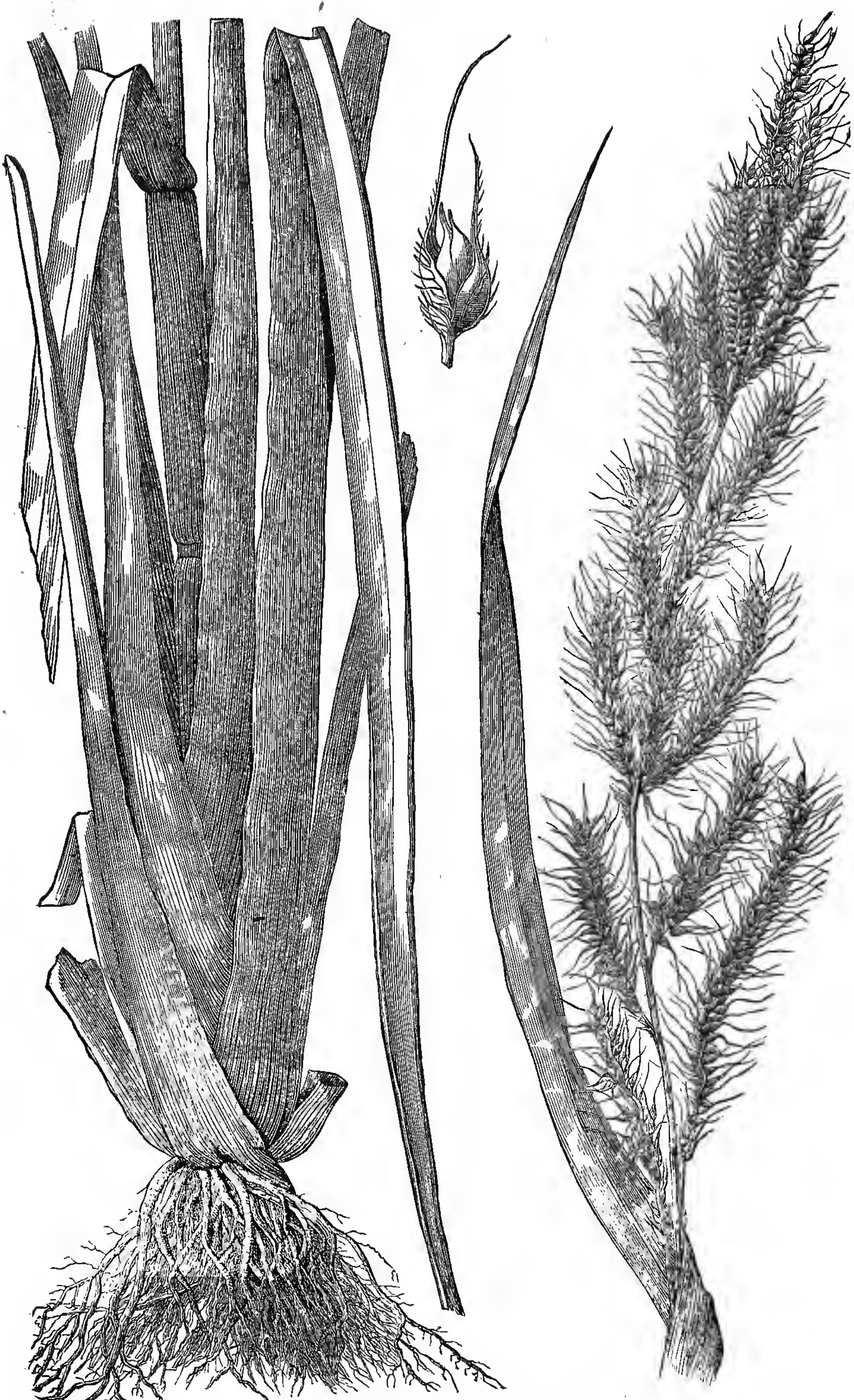
FEATHER GRASS.



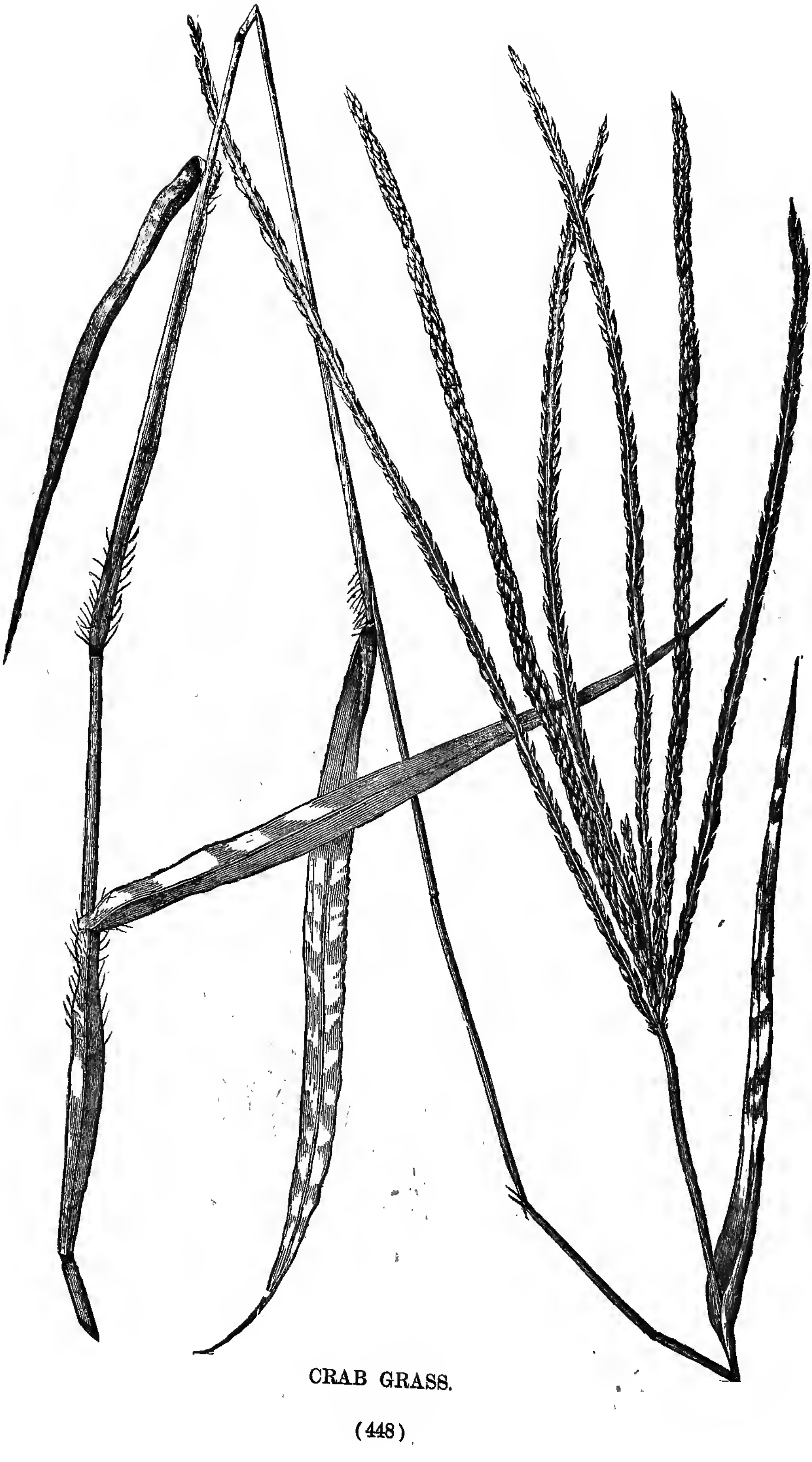
DROP SEED—NIMBLE WILL.



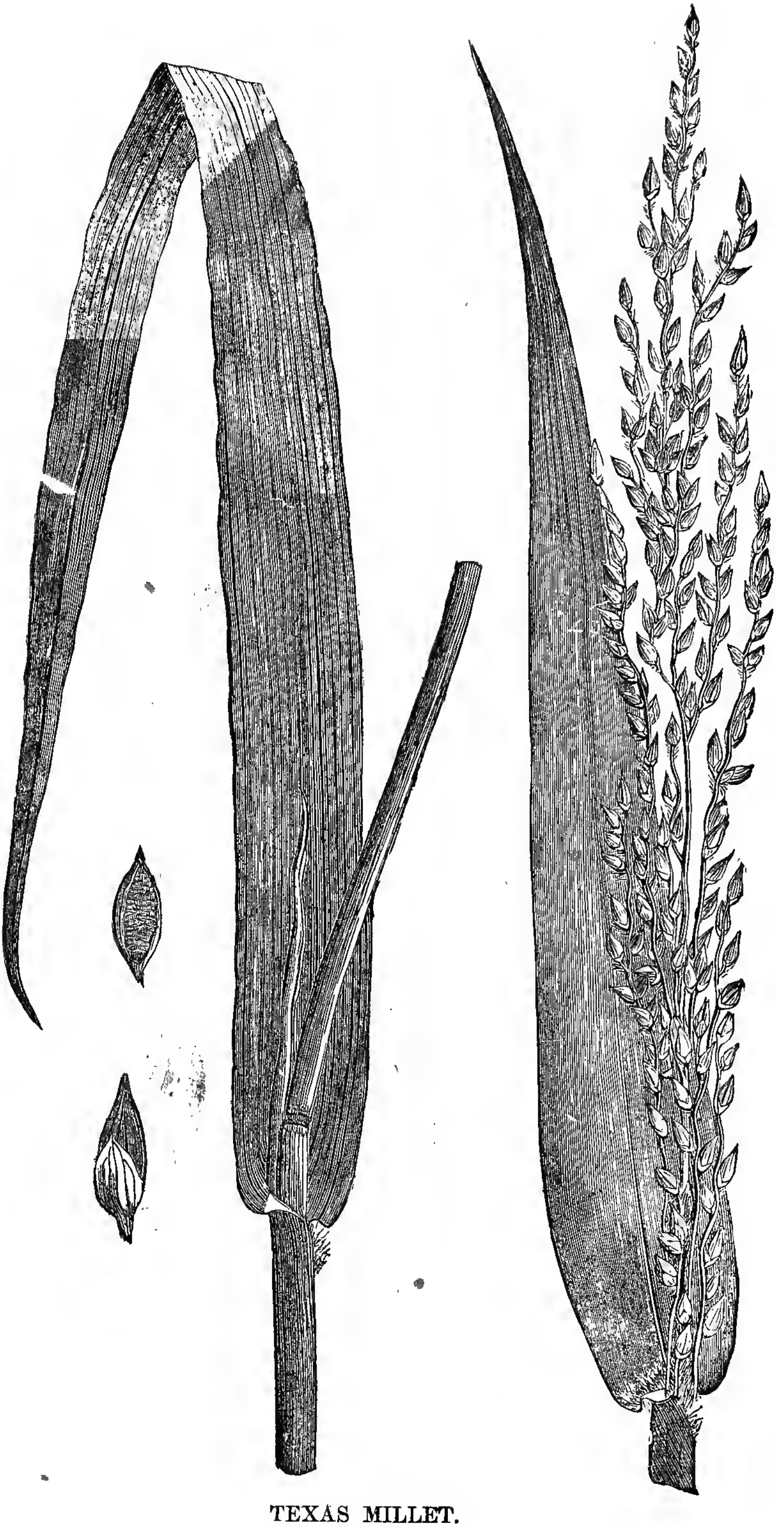
WATER GRASS.



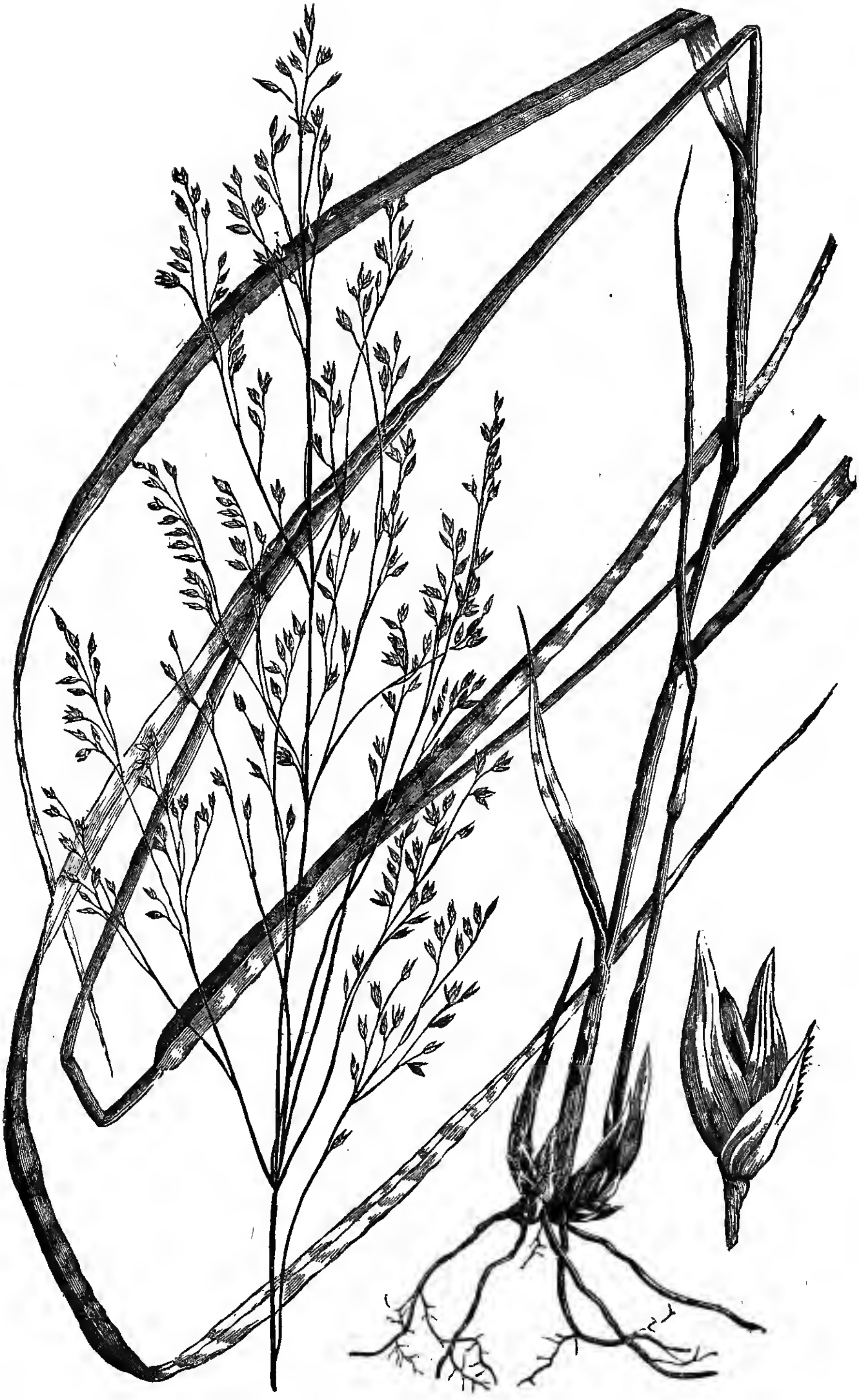
BARNYARD GRASS—COCK'S FOOT.



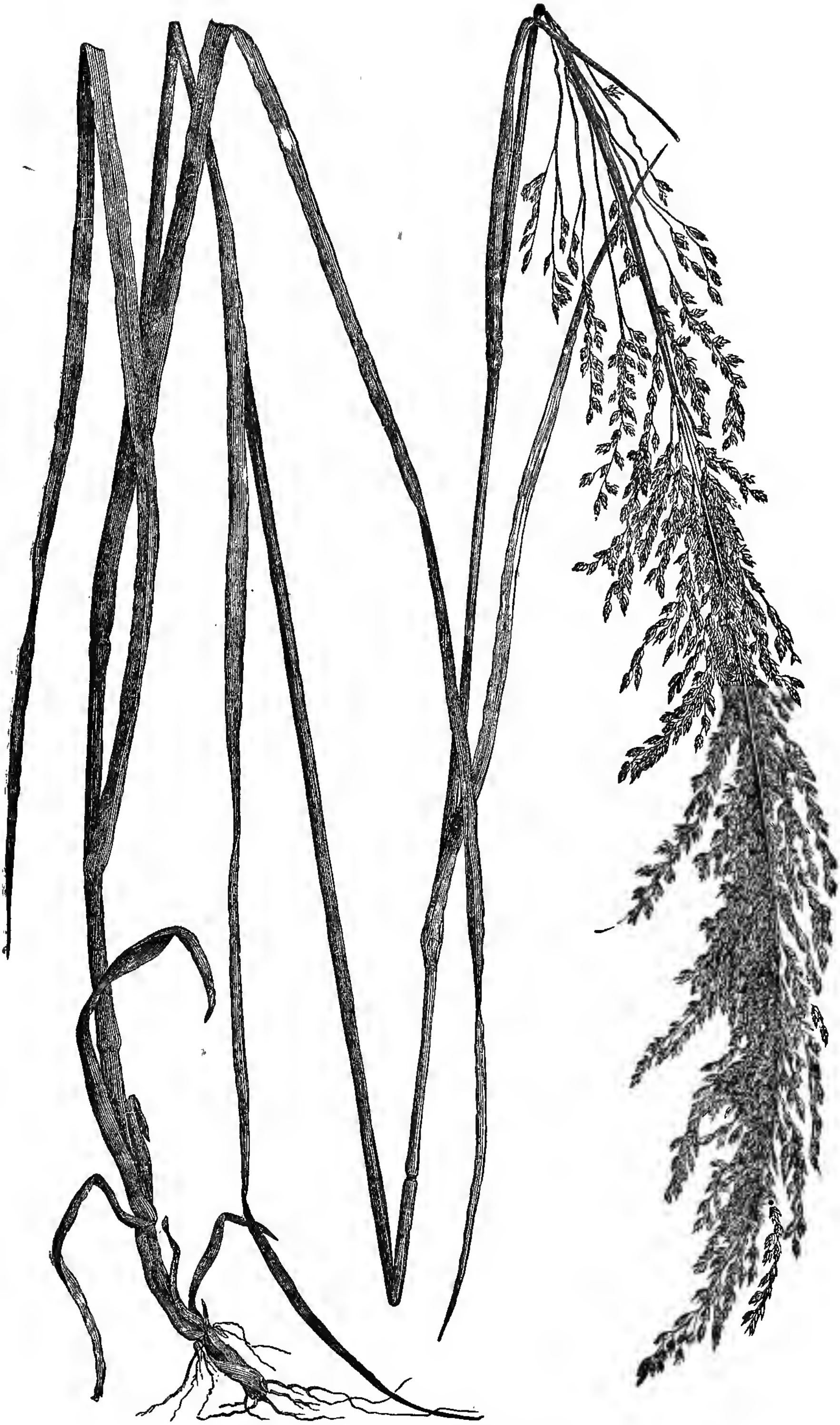
CRAB GRASS.



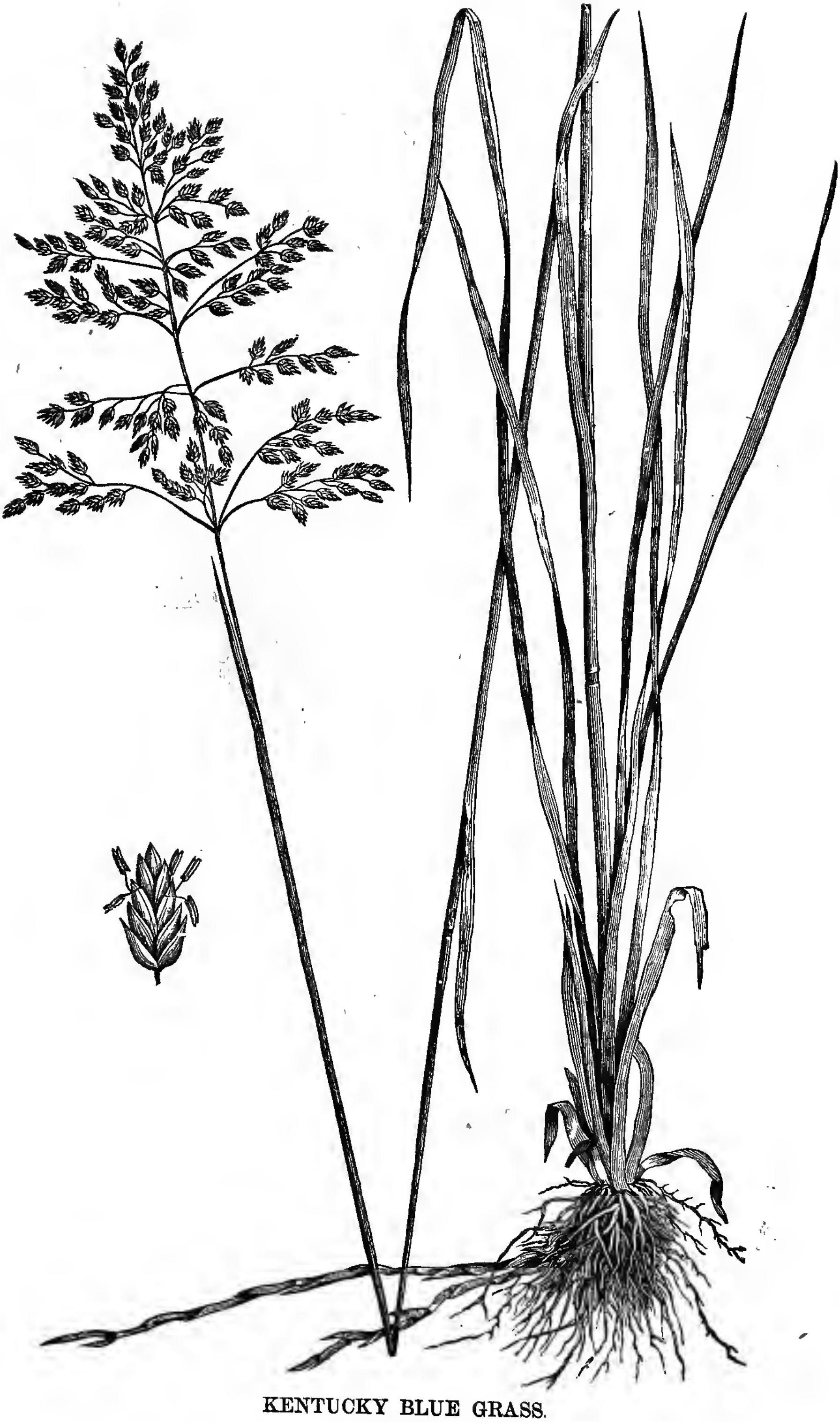
TEXAS MILLET.



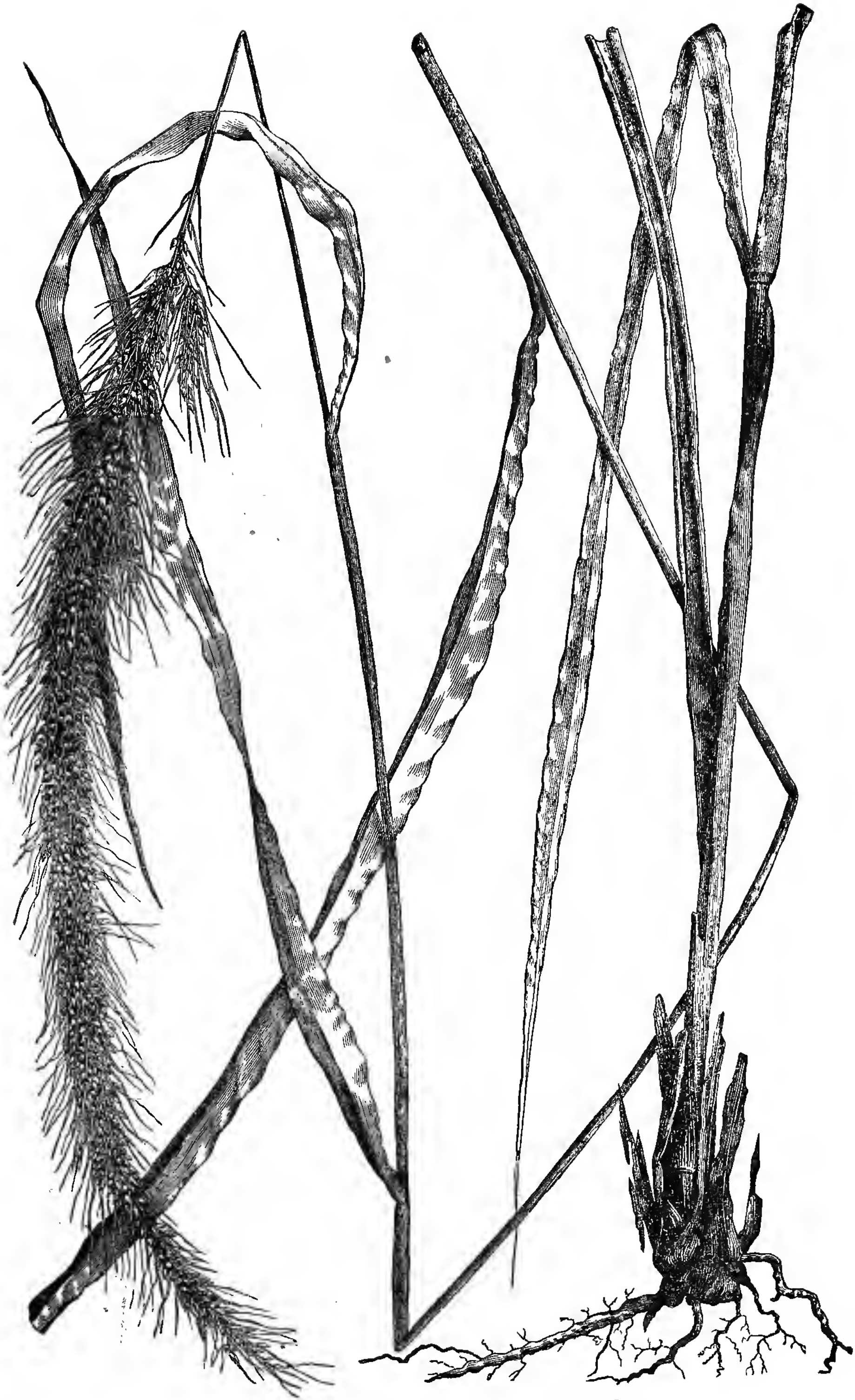
TALL PANIC GRASS—SWITCH GRASS



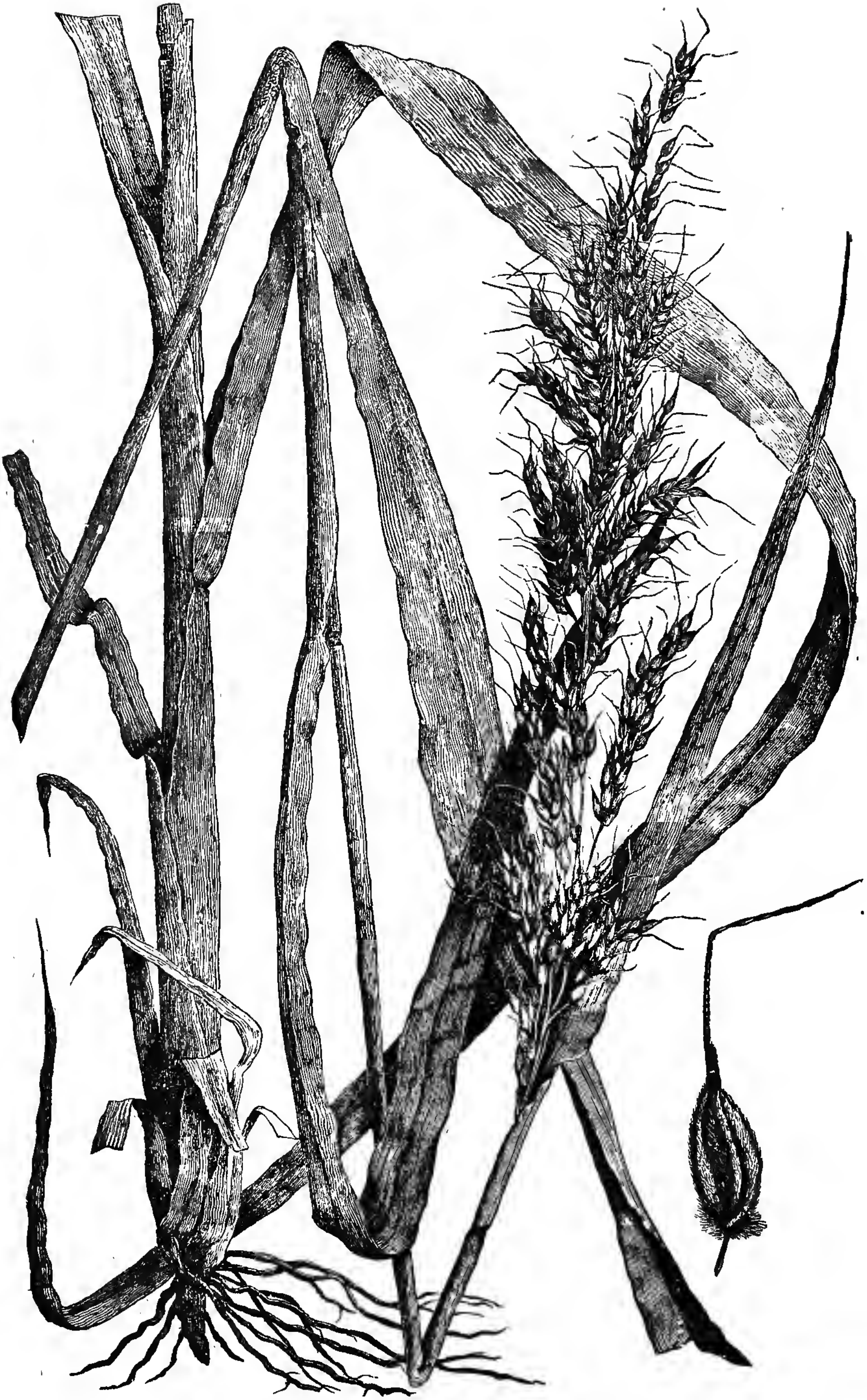
FOWL MEADOW GRASS.



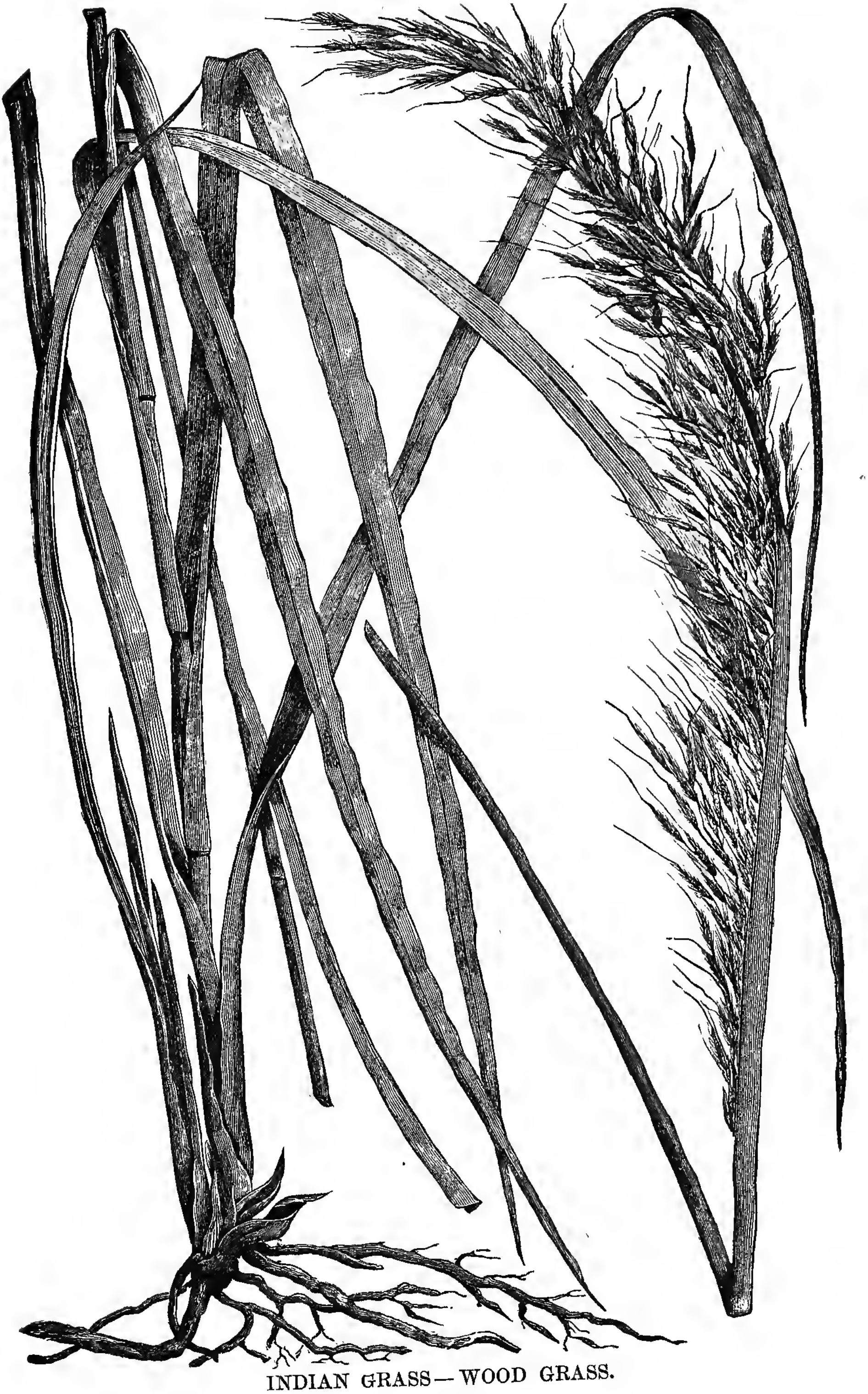
KENTUCKY BLUE GRASS.



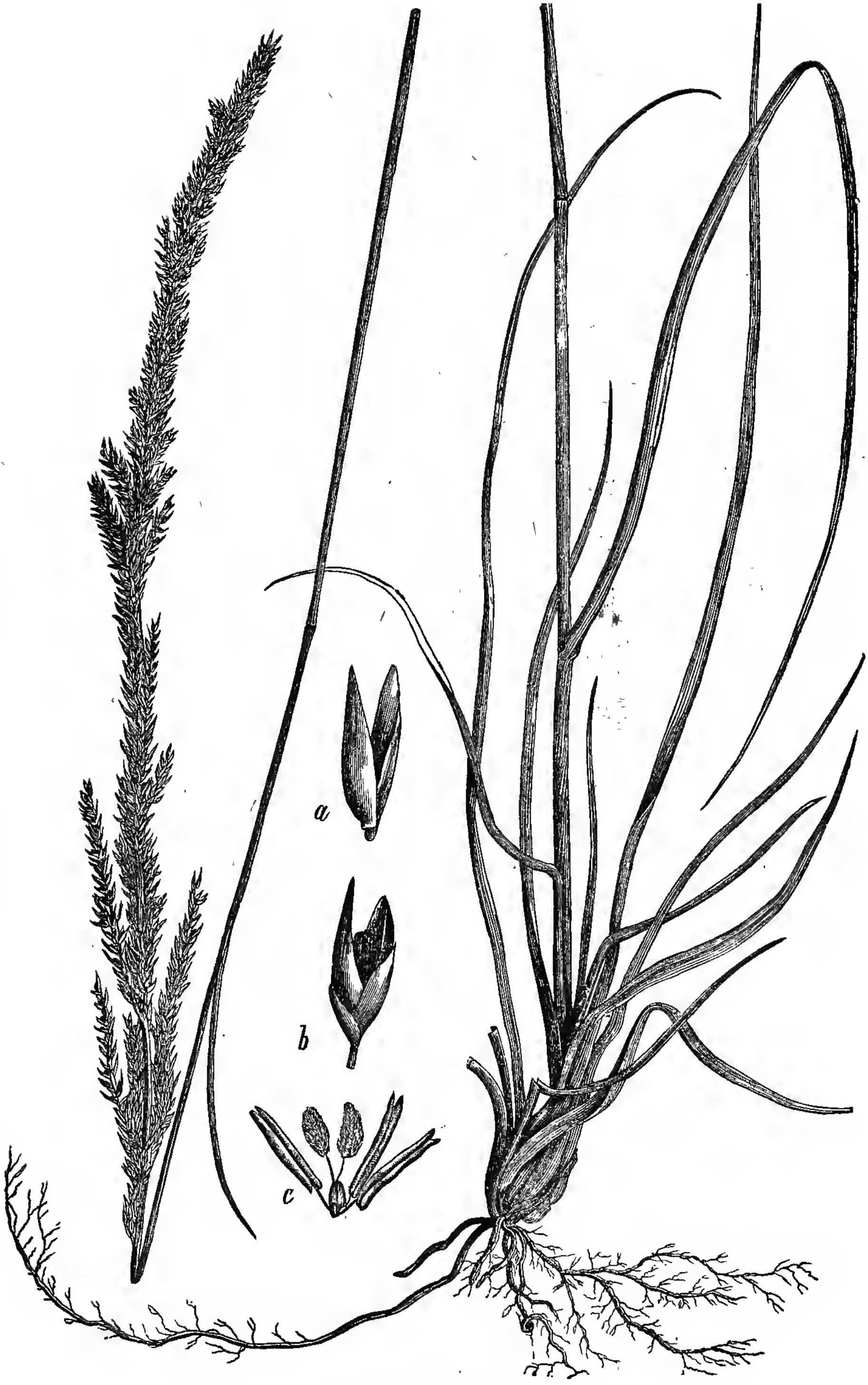
PIGEON GRASS—BRISTLE GRASS.



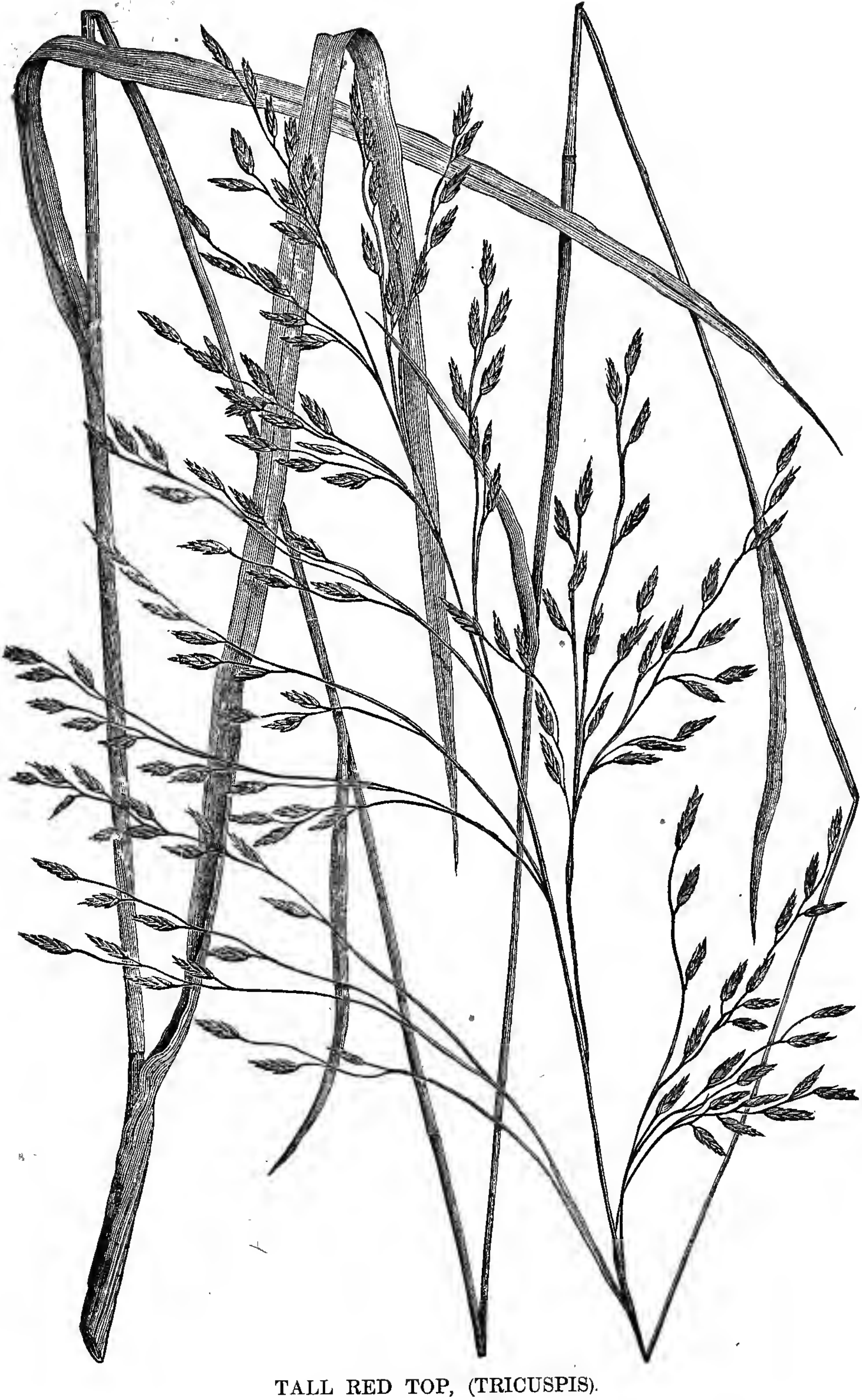
JOHNSON GRASS—FALSE GUINEA GRASS.



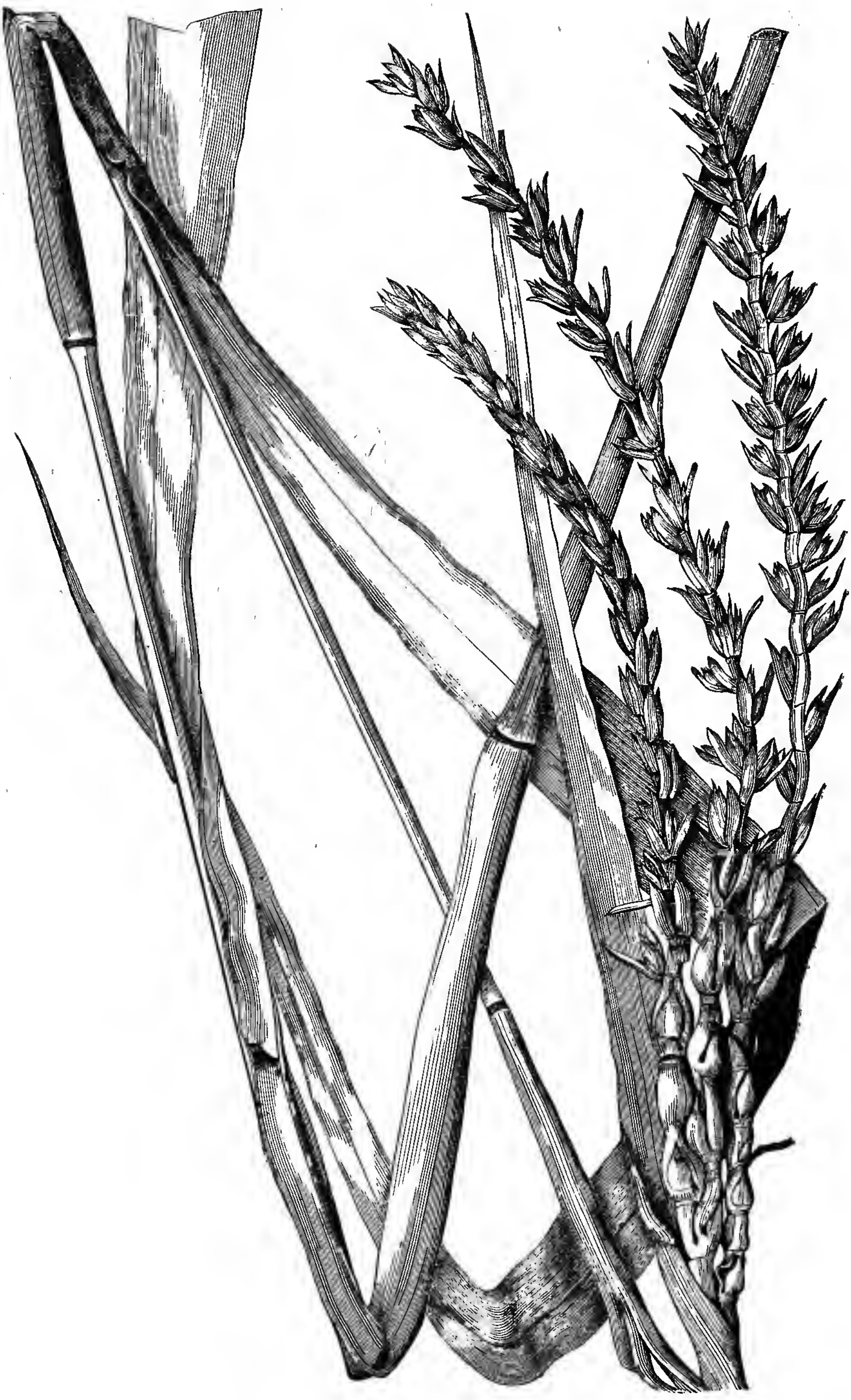
INDIAN GRASS—WOOD GRASS.



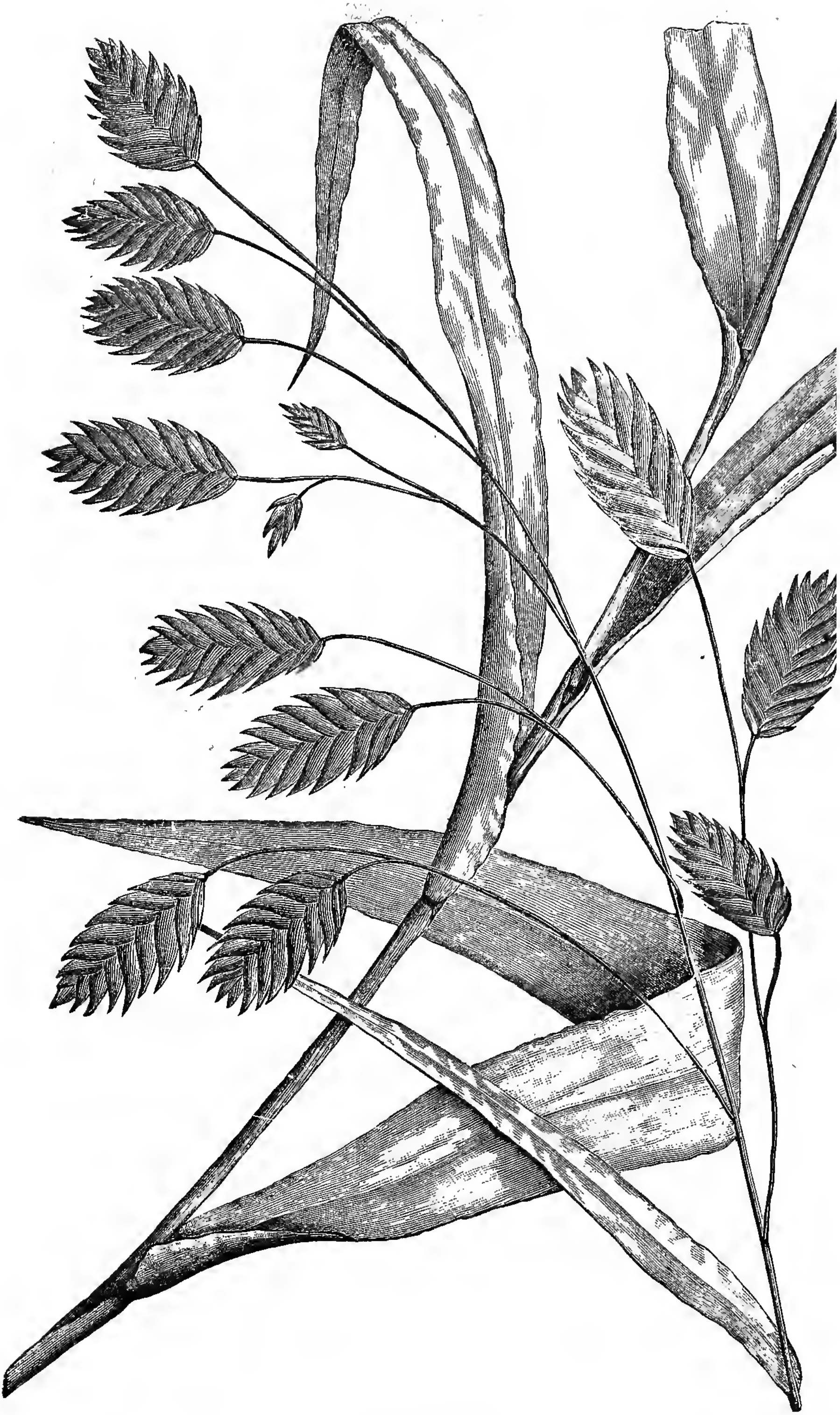
SMUT GRASS.



TALL RED TOP, (TRICUSPIS).



GAMA GRASS.



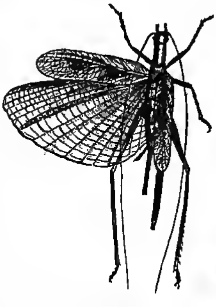
WILD FESCUE.

it can be cut every five or six weeks, yielding by its throwing out numerous stolons, increased crops until killed down by frost. The roots are easily protected during the winter by a good covering with ground, like the rattoons of sugar-cane, and allowing of a manifold division, afford the best means of propagation. These root-cuttings are set out in March or the beginning of April. This grass must not be confounded with the *Sorghum halapense* or Johnson grass, which is often improperly called Guinea grass, from its similar habit and appearance. *Panicum obtusum,* Obtuse-flowered Panic grass. This grass is similar in appearance to the *Panicum Texanum,* or Texas Millet, but is lower and less vigorous in growth, with narrower panicles and narrower and smoother leaves. It grows in South America, Mexico, New Mexico, and Texas. We do not know that it extends east of the Mississippi river, or that it has been tried with reference to its agricultural value. *Panicum sanguinale,* Crab grass. Prof. Killebrew, Tennessee, says: It is a fine pasture grass, although it has but few base leaves and forms no swards, yet it sends out numerous stems, branching freely at the base. It serves a most useful purpose in stock husbandry, and the northern farmers would congratulate themselves very much if they had it to turn their cattle on while the clover fields and meadows are parched up with summer heat. It fills all our cornfields, and many persons pull it out, which is a tedious process. It makes a sweet hay, horses are fond of it, leaving the best hay to eat it. *Panicum Texanum,* Texas Millet. An annual grass two to four feet high, sparingly branched, at first erect, becoming decumbent and widely spreading, very leafy, sheaths and leaves finely soft—hairy, margin of the leaves, rough; leaf blades six to eight inches long and one-half to one inch wide, upper leaves reaching to the base of the panicle, or nearly so; panicle six to eight inches long, strict; the branches alternate, erect, simple, three to four inches long, with somewhat scattered sessile spikelets. A grass of vigorous, rapid growth. It is very leafy, the leaves broad, rather thin, sprinkled with short, soft hairs. It grows two to three feet high, but the spreading stalks are often four feet or more in length, growing very close and thick at the base, and yielding a large amount of food. *Panicum virgatum,* tall Panic grass, Switch grass. A tall, perennial, southern grass three to five feet high, growing mostly in clumps in wet or moist soil, particularly near the coast; a good and prolific grass, if cut when young; when ripe it becomes harsh and unpalatable. It forms a considerable constituent of the native grasses of the prairies, particularly of moist localities. *Poa Serotina,* Fowl Meadow grass. This grass is closely related to the Kentucky Blue grass (*Poa pratensis*). It grows taller than that species, and is better adapted for a meadow grass than for pasture. This species is most common in the Northern States, particularly north of Pennsylvania. It is a good grass for moist meadows. In Wisconsin, where many natural meadows of this grass occur, it is highly esteemed. *Poa Pratensis,* Kentucky Blue grass. This grass is too well known to need an extended description. Prof. Killebrew, of Tennessee, truly says of this grass, it would seem a work of supererogation to argue as to the advantages of cultivating this grass. All know its benefits, and all see around them the great increase in the value of the land covered by it. It grows readily in all parts of the United States, north of latitude 40°, and lower down on suitable soils. It flowers in the earliest summer, and gives rich pasturage, except in the driest months, all the year. It varies in size in different localities, according to soil and climate. From the unexampled success its cultivation has met with in Kentucky, it has acquired the name of Kentucky Blue grass, though in the New England States it is known by the name of June grass. In all the middle portions of the United States it forms the principal constituent of the turf, though its excellence is rather depreciated in the Eastern States. In some sections it has been used as a hay, but it is not a success as a meadow grass, its chief excellence being exhibited as a pasture grass. It endures the frosts of winter better than any other grass we have, and if allowed to grow rank during the fall months, it will turn over and hide beneath its covering, the most luxuriant of winter croppings. Many persons, South and West, pass their stock through the entire winter on it alone, feeding only when the ground is covered with snow. (See article Blue Grass for further description.) *Setaria setosa;* Pigeon grass, Bristle grass. There are two species of *Setaria* or Pigeon grass which are very common in cultivated fields in the Northern States, springing up after the cutting of grain, and often yielding a fair crop for the scythe. In some of the Southern States, and particularly Texas, there is another species, the one above named, which is of larger and stronger growth. Its habit is much like the Italian millet, which is *Setaria Italica,* and its use and value are probably much the same as that species. *Sorghum halapense,* Johnson grass, False Guinea grass. A perennial grass with strong, vigorous roots, and abundance of long and tolerably broad leaves. Its stems attain a height of from five to six feet, with a large and spreading panicle. The flowers and seeds are much like those of broom corn, but the panicle is finer and more spreading. It has been much discussed in the Southern journals. It has been dreaded by planters because it seems almost impossible to exterminate it when it has once been established. *Sorghum nutans,* Indian grass, Wood grass. This is a perennial, tall grass, having a wide range over all the country east of the Rocky mountains. It grows rather sparsely and forms a thin bed of grass. The stalks are three to four feet high, smooth, hollow, straight, and having at the top a narrow panicle of handsome straw colored or brownish flowers, which are rather drooping in fruit. This grass has not usually been considered of much agricultural value, but it forms an important part of the native grass of the western prairies, and, if cut early, forms good and nutritious hay. In the Southern States and in Texas, there are two additional species or varieties which are not materially different. *Sporobolus Indicus,* Smut grass. A native of India, but now spread over many countries. It occurs more or less abundantly in all the Southern States, and is called smut grass, there from the fact that after flowering, the heads become affected with a blackish smut. Mr. D. L. Phares, of Mississippi, says that it grows luxuriantly in uncultivated lands, and is eaten by cattle and horses, and seems valuable. Dr. Gattinger, of Nashville, Tenn., says: All parts of the plant are equally pliant and succulent. It sprouts again after being pastured down, with numerous new culms, and its growing season lasts from May till frost. The culms stand about two feet high, and, as I have observed it, always growing in patches. It grows in low and small tufts, and holds to the soil. *Tricuspis seslerioides,* Tall Red-top. This grass grows from three to five feet high. It is very smooth; the leaves are long and flat, the lower sheaths hairy or smoothish. The panicle is large and loose, at first erect, but finally spreading widely; the branches in pairs or single, naked below, flowering towards the extremities and becoming drooping. The spikelets are five to six flowered; three to four lines long, purple, on short pedicels. The glumes are shorter than the flowers, unequaled and pointed; the lower palet is hairy toward the base, having three strong nerves which are extended into short cusps or teeth at the summit. It is a large and showy grass when fully matured, the panicles being large, spreading, and of a handsome purplish color. Instead of being called Tall Red-top it would be much more properly called Purple-top. It grows in sandy fields and on dry, sterile banks, from New York to South Carolina, westward to the prairies, and southwestward to Texas, where several other species also occur. *Tripsacum dactyloides,* Gama grass. A tall perennial grass, with solid culms, broad and flat leaves, and with flower-spikes from four to eight inches long, produced from the side joints or from the top, either singly or two to three together. The upper portion of these spikes is staminate or male, and the lower portion pistillate and producing the seeds. It grows from three to six feet high, with large broad leaves resembling those of Indian corn. The upper or male portion of the flower-spikes drops off after flowering, and the fertile portion easily breaks up into short joints. These joints are thick and polished, and the flowers and seeds are deeply imbedded in them. Mr. Howard in his Manual of Grasses, says: This is a native of the South, from the mountains to the coast. The seed stem runs up to the height of five to seven feet. The seeds break off from the stem as if in a joint, a single seed at a time. The leaves resemble those of corn. When cut before the seed stems shoot up they make a coarse but nutritious hay. It may be cut three or four times during the season. The quantity of forage which can be made from it is enormous. Both cattle and horses are fond of the hay. The roots are almost as large and strong as cane roots. It would require a team of four to six oxen to plow it up. It can, however, be easily tilled by close grazing, and the mass of dead roots would certainly greatly enrich the land. As the seeds of this grass vegetate with uncertainty, it is usually propagated by setting out slips of the roots about two feet apart each way. On rich land the tussocks will soon meet. In the absence of the finer hay grasses this grass will be found an abundant and excellent substitute. The hay made from it is very like corn fodder, is quite equal to it in value, and may be saved at a tithe of the expense. *Uniola latifolia,* Wild Fescue. This is a handsome grass, with larger spikelets than any other we have mentioned; in form they are somewhat like those of Bromus uniloides, and like them are very flat and compressed. Mr. Chas. Mohr, Mobile, Ala., says: A fine vernal grass, with a rich foliage, blooming early in May; two to three feet high; frequently in damp, sandy loam, forming large tufts. This perennial grass is certainly valuable, affording an abundant range early in the season; if cultivated it would yield large crops ready for cutting from the first of May. It is called by some Wild Fescue or Oat grass. It is not found near the coast, consequently I had no chance to observe its growth during the latter part of the summer, and in the winter season, and therefore am not able to judge of its value as a pasture grass. It grows as far north as Pennsylvania, but it is less vigorous in growth as it advances northward. The following glossary of terms, used in describing grasses, will be of advantage to the general reader, for identifying species named here. (See, also, Supplement, Grasses, for new varieties.)

Acuminate—Extending into a long, tapering point.
Acute—Sharp-pointed.
Annual—Living through one season only.
Anther—The upper part of the stamen containing the pollen or fertilizing powder.
Awn—A bristle-like process proceeding from or attached to the glumes or palets of some grasses.
Biennial—Living through two seasons.
Boat-shaped—Concave within and convex without, as the glumes and palets of some flowers.
Bristles—Short, stiff hairs.
Bulbous—The base of the stem thickened so as to make a hard, roundish mass, as in Timothy grass (*Phleum pratense*).
Cæspitose—Growing in bunches or tufts.
Cauline—Relating to or growing from the stem or culm.
Ciliate—Having the margin fringed with hairs.
Culm—The stem or straw of a grass; when the stem creeps upon or under the ground it is called a *rhizoma.*
Decumbent—Leaning on the ground at the lower part but rising at the top.
Digitate—Branching finger-like from a common center, as the spikes of Crab-grass (*Panicum sanguinale*).
Diœcious—The two sexes separated and growing on different plants, as in Buffalo grass (*Buchloë dactyloides*).
Entire—Without notches on the margin.
Exserted—Protruded beyond the flower, as the stamens of grasses usually are when in bloom.
Fertile—Producing fruit.
Fibrous—Composed of thread-like fibers, as the roots of most grasses.
Floret—A little flower; a pair of palets with the inclosed stamens and pistil. There may be many of these in a spikelet.
Glabrous—Smooth; destitute of hairs or roughness.
Glumes—The outer or lower pair of bracts or scales in a spikelet, and inclosing one or more, sometimes many, flowers or florets.
Hirsute Rough-haired, bearded.
Indigenous—Growing naturally in a country.
Internode—The space between the nodes or joints.
Keel—A sharp ridge along the middle of a glume or palet resembling the keel of a boat.
Lamina or Blade—The extended part of a leaf, generally open and flat, but sometimes rolled inward longitudinally, when it is said to be involute.
Ligule—A small leaf-like appendage, usually thin and semi-transparent (membranaceous), found at the lower part of the leaf or at the top of the sheath. It is said to be entire when there are no divisions in its outliner; bifid, when it is divided at the apex into two parts; lacerated, when it is cut or divided on the margin; truncateo, when the upper part terminates abruptly in a transverse line, as if cut off.
Membranaceous—Thin and translucent, like a membrane.
Nerves—Rib-like elevations on the leaves, glumes, and palets.
Neutral flower—One having neither stamens nor pistil.
Nodes—Knots in the culm where the leaves are given off.
Oblong—Longer than wide, with the sides nearly parallel.
Obtuse—Blunt pointed.
Ovary—The portion of a flower containing the ovules or seeds.
Palet or Palea—The inner scales or bracts inclosing the stamens and pistil.
Panicle—The flowering part of the stem or culm of grasses, usually composed of a number of series or whorls of branches or rays, which are again divided into secondary branches. These may be short and close to the stem, or they may be long and spreading.

Perennial—Living for more than two years; indefinitely.
Pistil—The central organ of a fertile flower, usually consisting of an ovary, style, and stigma.
Pollen—The fertilizing powder contained in the anthers.
Pubescent—Covered with soft hairs.
Rachis—The name given to that kind of flowering branch where the flowers are arranged closely together on its sides without stalks or pedicels, as in Paspalum, and in the ultimate branches of the panicle.
Radical leaves—Those growing from the root.
Spikelet—The ultimate divisions of the panicles or flower-heads; they may be one-flowered, that is, a pair of glumes enveloping a single flower of a pair of palets (or sometimes one palet) with the inclosed stamens and pistil; or they may be two or more flowered, there being but one pair of glumes to each spikelet, whether it be one or many flowered.
Sheath—That part of the leaf which clasps the stem; it answers to the petiole or leaf-stalk.
Spike—When the flowers are sessile or without branches, as in Timothy grass (*Phleum pratsnse*).
Stamens—The organs of the flower which contain the pollen, consisting of the filament and the anthers.
Stigma—The extremity of the pistil which receives the pollen.
Whorl—A number of leaves or branches starting from one line on the stem.

GRASSHOPPER. The insects we commonly call grasshopper are really locusts. They will be treated of under that head. In fact, all jumping insects of the Grillidæ, including crickets, and katydids, are often called grasshoppers, as well as the locusts, the latter being, as a rule, more common than the long-winged grasshoppers. It would be better if the name grasshopper was only applied, as it might properly be, to that class of jumping insects with green bodies, and the wings and wing coverts of which are considerably larger than the body. To this class would belong the katydid. (See Katydid.) As illustrating one of the species of terrestrial grasshoppers, we give a cut of the Slender Meadow grasshopper, (*Orchilemum vulgari,*) a common meadow grasshopper, the name signifying to dance in the meadow. From the middle of summer until the fall our meadows are often filled with these grasshoppers, as they often are with true locusts, of which the red-legged species (*Acrydium femur-rubrum*) is most common. In seasons when grasshoppers are very thick they may be kept down by passing over the field with a large bag-net of millinet, attached to a hogshead hoop, and a proper handle. By using a horse for riding, a man will thus catch immense numbers, and being dried, they may be sold in large cities as food for mocking-birds, and other soft-billed species kept in confinement. (See Katydid and Locust.)



SLENDER MEADOW GRASS-HOPPER.

GRASS, ORNAMENTAL. The varieties of ornamental grasses are numerous, and some of those recently introduced are especially beautiful. The annual ornamental varieties are too well known to need description, as are some of the finer of the perennial varieties. *Erianthus ravennæ,* (see cut above) resembles the celebrated Pampas Grass, but is hardy, at least to the latitude of 42° north, with slight covering in winter. It grows to a height of nine to twelve feet, and is handsome as a specimen plant on he lawn. It may be grown from seed, but is better propagated by division of the roots.

Pampas grass, (*Generium argenteum,*) is a native of South America, and is a magnificent object, but unfortunately not hardy north of 38°. It is undoubtedly the finest of the strong growing ornamental grasses in cultivation, and if entirely hardy would be found in every collection, as a single specimen or as a center to a large bed. In favorable situations it is well worthy a place in large collections, even as far north as latitude 42°, where means of protection, by brush, litter, and frame work can be used. *Statice Latifolia,* although not a grass is introduced here on account of its great beauty, and as being used as are the ornamental grasses for winter bouquets when dried. The cut below shows this elegant object.

ERIANTHUS RAVENNÆ.

STATICE LATIFOLIA.

The foliage is broad and luxuriant, and the flowers lilac, and borne in large trusses. The family Statice comprises many species of hardy, half hardy, and greenhouse, annuals, biennials, and perennials. *S. maritima* is the well-known

Sea-pink or thrift, excellent for edging. *S. arborea*, is a green-house evergreen shrub.

GRAVEL. Water worn pebbles, loosely interspersed, more or less abundantly, in a sandy or clayey medium. It is of every degree of fineness, chemical composition, and value in farming. Those gravels containing silicious pebbles chiefly, and of a large size, are nearly unfit for tillage, and the value increases with the presence of slates, granites, hornblende, mica, marl, and clay. They are usually very porous, draining water off rapidly, and can not be of much value, unless incumbent on a subsoil that holds water at some little depth. If the gravel be fertile, it is usually warm and best adapted to roots. Stiff marls, burned clay, and an abundance of vegetable matter are to be used as manures. Gravel is well adapted for forming walks in gardens and the surface of roads.

GRAVEL. In farriery, the formation of hard calculi or stones in the bladder, or of a sandy sediment.

GRAVEOLENT. Fetid, having a strong odor.

GRAVES, GREAVES. Membranous matter left as refuse by the tallow-melter; it is used for feeding dogs, and given to poultry. Graves contains a large amount of fat, and is admirably adapted for fattening hogs, etc.; it has been used, also, as a manure; 200 pounds interspersed in stable manure may be added to the acre; but the most economical plan will be to compost in the nitre bed. It is a nitrogen manure, 100 pounds yielding about thirteen pounds of ammonia, and being equal, in this respect, to about one and a half tons of farm-yard manure. The presence of sulphur and phosphorus, besides bone earth, also constitute it a manure applicable to all rich crops; as corn, wheat, tobacco, etc., the only consideration being the economy of using so high priced an article. (See Manures.)

GRAVID. Pregnant.

GRAVITATION, GRAVITY. The tendency that masses have to approach each other; also called attraction of gravitation. The gravity of a body is therefore the attraction it extends toward other bodies; it increases with the bulk, density, and nearness of bodies, being directly as their density and mass, and inversely as the squares of their distances. Weight, and the descent of all bodies toward the earth's surface, is an effect of the earth's gravity, or terrestrial gravitation.

GRAZING. The turning of stock upon pasture, that they may seek their own food, is termed grazing. When they are turned upon an unfenced range and watched, it is termed herding. The question of grasses adapted to grazing is an important one to every farmer. The subject in its various branches will be found fully treated of under grass, clover, forage plants, and feeding.

GREASE IN HORSES. This is eczema of the heels, or inflammation of the heels and fetlocks, with formation of vesicles, and pustules, throwing out a fetid, watery discharge. This disease is owing to bad keeping and grooming, and a low condition of the system. It differs from the scratches in that the skin is moist. Sometimes granulations appear called grapes. The first thing to do is to move the bowels with from four to six drachms of aloes in a pint of water. Groom and blanket the horse, and keep in a warm stable. If there are granulations, sprinkle them with powdered sulphate of zinc. If the case is more simple, dusting with dry oxide of zinc, after washing clean with soft warm water and castile soap, will effect a cure. If there is a bad odor, use weak carbolic acid water, or make a wash of one ounce of sulphate of copper dissolved in a pint of water, to which afterward add one pint of whisky or rum. Apply two or three times a day, keeping the parts bandaged.

GREEN CROPS. Such crops, roots, etc., as are fed off the land or used in soiling, before becoming ripe and fit for storage. When plowed into the ground, any growing crop may form green fallows.

GREEN DYE. This is produced, in all its shades, by using a bath of blue, and then yellow.

GREEN FALLOW. Green crops plowed into the soil.

GREEN GRASS. Probably *Poa angustifolia,* applied also to Blue grass, *Poa pratensis* and *P. compressa.* An early and late pasture grass, much esteemed in the Eastern States. It bears water well, but is occasionally subject to rust. (See Grasses.)

GREEN-HOUSE. A conservatory. This should be distinguished from a hot-house, in which artificial heat is used. It is covered with glass either on one or both sides, if on one only, that should have a southern aspect. Plants are stored here in pots or frames, fruit-trees trained against the wall, and the roof partially covered with grape-vines. They are used to protect tender plants from winter, and advance the ripening of fruits. An Orangery is a place of deposit for orange and other trees set in pots, which produce their shoots in summer, and are then transferred to the open air. It does not always have a glass roof, but is frequently a pit dug in the soil on the hill-side, and covered, the south side of which only is glazed. In very severe weather the glass of the green-house may be covered with mats, and the temperature should not sink to the freezing point.

GREEN MANURES. Manures plowed into the land in a fresh or green state, especially green fallow crops. The principal plants used for this purpose are clover of various kinds, buckwheat, grasses, oats, rye, tares, various beans, lupins, spurry, borage and turnips running to flower; young Indian corn, mustard, and, indeed, nearly all herbage the seeds of which are not too expensive, have been proposed. But there are two points worthy of consideration in the use of these plants: 1st. That some improve the soil much more rapidly than others, viz., clovers, grasses and buckwheat. 2d. That an excess of green matter turned into the soil is disadvantageous, bringing on a tendency to mildew; it is best, therefore, to scatter lime over a green fallow, harrow it in, and sow the seed within a few weeks, unless the soil is very stiff; for the gaseous matter given out by the decomposition of the manures will be serviceable to plants, and should not be lost. In stiff soils make the fallow in the fall. By this means lands are very rapidly brought up if they are merely deficient in vegetable matter; the expense is also much less than by the accumulation and spreading of other manures. Sea-weeds, weeds cropped from the soil, etc., are also called green manures when plowed into the soil in the fresh state. Some writers use the term green manure for long or unfermented dung.

GREEN SAND. New Jersey marl. One of the upper secondary deposits of geologists, consisting, for the most part, of a sandy formation, the grains of which are, however, much softer than those of common sand, and consist of silicate of iron chiefly; they are of several colors, from greenish gray to deep green and olive. It is extensively developed in the United States, being found in the valley of the Connecticut, southeastern portion of New Jersey, Delaware, and Virginia. Some portions of this deposit contain from seven to twelve per cent. of potash combined with silicate of iron. This is particularly the case with that in Monmouth and Burlington counties, N. J., and Newcastle county, Del. Numerous pits are therefore, opened for the purpose of reaching this deposit, called Marl, which has been found, in many instances, to produce remarkable fertility when applied at the rate of 200 to 400 bushels on stiff clayey lands. In selecting specimens, we are to examine the amouut of green sands in it, the fertility depending upon them; for the clay, common sand, and other impurities are of little importance. The richest kinds are of a deep green internally, sometimes with an olive tint, but the exterior becomes grayish and covered with a slight efflorescence; it is also readily crushed. The following analysis of a specimen from Monmouth county will give the particulars of its composition per cent.:

Silica	50.00
Alumina	7.00
Protoxide of iron	22.00
Potash	11.00
Lime	1.00
Magnesia	a trace
Water	9.00
	100.00

The potash here is combined with silica, but their union is readily destroyed by the carbonic acid of the soil, which rapidly forms carbonate of potash. This manure is peculiarly applicable to grass, oats, wheat, corn, and the *Cerealia* generally; it will also be serviceable to roots growing on a stiffish soil. It may not, however, pay the expenses of long transportation, a small quantity of ashes replacing it in the compost heap, and is little used except when near at hand.

GREENSTONE. A species of trap consisting of feldspar and hornblende. It is a fused and intruded rock.

GREEN VITRIOL. Sulphate of protoxide of iron. It is styptic, emetic, and much used in dyeing and inkmaking.

GREYHOUND. A coursing dog, remarkable for his swiftness and symmetry.

GREYWACKE. *Grauwacke.* A conglomerate of rounded pebbles and sand, naturally cemented together.

GRIP. A small drain.

GRIPES. Colic, which see.

GRIT. A hard sandstone usually coarse.

GROATS or **GRITS.** Oats prepared by hulling.

GROGGINESS. Any disease of the feet, as founder, or navicular disease, will produce that tenderness of movement called grogginess. (See Founder, Navicular disease, and also Horse's Foot.)

GROIN. In architecture, the junction of two arches.

GROSSULARIA. The generic name of the currant and gooseberry.

GROUND-BAIT. Balls made of grain, graves, bran, lentils, mixed with clay, and thrown in those parts of a pond or river where angling is carried on.

GROUND-CHERRY. Several varieties of *Physalis.*

GROUNDSEL. *Senecio vulgaris.* A homely, worthless weed known as ragwort, and naturalized from Europe in various portions of the United States. De Candolle has remarked of this weed, that it migrates almost everywhere with European man.

GROUSE. Among the sub-families of that known as *Tetraonidæ*, the grouse sub-family is a most important one from the value of the flesh of the species. North America is conceded to contain more species of this valuable game bird than any other country in the world. It is more than probable that America is in this respect superior to all other countries, since the cock of the plains rivals in size, that of any country. The principal species of American grouse are as follows: Cock of the plains (*Centrocercus urophasianus*), found on the far Western plains, the males weighing sometimes from six to seven pounds. The Ruffed grouse (*Bonasa umbellus*), is abundant North, South and West, and is commonly known as the partridge and also pheasant. Sabines grouse (*B. Sabinei*), found west of the Rocky mountains, is deep red in hue, as to the ground work of the feathers, and the excellence of its flesh is fully equal to the last named. The Allied grouse (*B. umbelloides*), inhabits the Rocky mountains, and north to the Arctic circle, is light gray in color, differently marked from the Eastern partridge, and is much smaller. The Prairie hen—pinnated grouse—(*Cupidonia cupido*), was formerly abundant from the Atlantic coast to Kansas. It is now nearly or quite extinct East, and not nearly as abundant West as formerly, except in Iowa, Minnesota and Kansas. Great numbers are killed yearly and sent to Eastern and European markets. The Sharp-tail grouse (*Pediocætes columbrianus*), takes the place of the pinnated grouse in the far West, and in its habits and the nature of its flesh resembles the prairie hen. The Arctic Sharp-tailed grouse (*P. phasianellus*), is a native of the far north, never being found within the limits of the United States. The three last named species are however said to be fertile together, the hybrids partaking sometimes more of one and sometimes more of the other parent. The Dusky grouse (*Dendragapus obscura*), is equal in size to the cock of the plains. It is a magnificent, white-fleshed bird, found in Northern California, and north into Oregon and Washington Territory, and south along the main chain of the Rocky mountains, as far as Texas. Richardson's grouse (*Dendragapus Richardsonii*), differs from the foregoing, though sometimes confounded with it. This species is found from the South pass of the Rocky mountains, northward, and along the slopes as far as the forests extend. It is never found upon the plains. The Spruce grouse (*Canace Canadensis*), inhabits the northern portion of the United States, and thence far north, even to the Arctic seas. Its home is in the thick forests, and swamps, and thus it is seldom met, unless specially hunted for. Franklin's grouse (*Canace Franklinii*), is a

HAY.—Rank and yield of the States, with average annual product for the past nine years.

Rank.	States.	Total value of Crop.	Value per Acre.	No. of Acres.	Amount of Crop. Tons.	Yield per Acre. Tons.
1	New York	$64,865,077	$15.10	4,417,545	5,299,200	1.20
2	Pennsylvania	39,407,587	17.22	2,324,901	2,849,500	1.21
3	Ohio	23,267,635	12.82	1,815,170	2,090,835	1.15
4	Illinois	22.678,771	10.92	2,114,303	2,897,162	1.36
5	Maine	13,689,853	10.94	1,250,947	1,200,162	.96
6	Michigan	12,101,875	14.12	910,232	1,088 040	1.19
7	Iowa	11,786,991	7.30	1,639,221	2,338,300	1.40
8	Wisconsin	11,628,893	11.48	1,012,678	1,357,262	1.34
9	Connecticut	11,435,821	21.89	533,667	650,437	1.21
10	Massachusetts	11,349,556	21.22	552,916	641,381	1.15
11	Vermont	11,220,229	11.55	994,134	1,061,910	1.07
12	California	11,134,170	20.19	564,152	822,325	1.45
13	Indiana	10,629,815	12.47	882 443	1,112,172	1.30
14	New Jersey	9,295,138	21.74	444,267	541,400	1.21
15	New Hampshire	8,655,229	12.38	691,589	701,700	1.02
16	Missouri	7,491,996	11.68	662,228	870,487	1.30
17	Minnesota	5,513,469	7.28	757,071	1,121,841	1.41
18	Kansas	4,822,948	6.06	791,961	1,262.100	1.58
19	Kentucky	3,911,954	15.21	258,824	321,785	1.24
20	Maryland	3,141,022	17.99	177,180	195,825	1.10
21	Virginia	3,022,380	17.08	178,154	208,237	1.15
22	West Virginia	2,698,690	13.36	204,879	237,061	1.15
23	Rhode Island	2,215,187	23.99	96,994	100,225	1 07
24	Tennessee	2,030,545	18.05	113,631	145,830	1.28
25	Nebraska	1,764,839	5.52	317,007	523,950	1.64
26	Oregon	1 485,417	17.52	85,660	130,225	1.51
27	North Carolina	1,319.829	15.39	86,257	111,611	1.29
28	Nevada	976,500	25.92	38,398	53,400	1.41
29	Texas	906,621	15.29	61,333	79.950	1.32
30	Delaware	632,730	19.46	32,802	34,419	1.04
31	South Carolina	420,711	20.86	20,375	22,662	1.11
32	Georgia	419,208	24.08	17,899	24,599	1.36
33	Alabama	377.903	21.82	17,166	23,100	1.32
34	Mississippi	355,805	25.27	14,332	20,540	1.81
35	Arkansas	268,401	19.88	13,445	18,398	1.35
36	Louisiana	257,989	23.87	10,796	13,475	1.25

native of the Rocky mountains, from latitude 50° to 54° on the high elevations forming the base of the snowy peaks. It was formerly considered the same as the Spruce grouse, but it differs in several points, and is a species by itself.

GROUT. In building, mortar made fluid with water. Plaster used for finishing walls. Mortar used in fixing foundations.

GRUB. The larva of May beetles, and similar species, found infesting meadows, fat compost heaps, rotten stumps, etc., generally short, thick larva, which, when handled, assumes nearly the form of a ring.

GRUBBER. A strong hoe for tearing up the roots of shrubs and trees.

GRUIDÆ. Birds which wade like the crane (*grus*).

GRYLLIDÆ. A family of locusts, resembling the *Gryllus*.

GUAIACUM. A resin obtained from the *Guaiacum officinale*, a West India tree. It is little used in medicine for rheumatism.

GUANO. One of the commercial manures, the excrement of sea birds, accumulated for ages upon rainless rocky islands of the South Pacific coast. When pure it is one of the most valuable of the special fertilizers. (See article Fertilizers.)

GUINEA CORN. Egyptian corn. Indian corn of a very small grain, used for popping, is so-called.

GUINEA FOWL. (See Poultry.)

GUINEA GRASS. (See Grasses.)

GUINEA PIG, or **CAVY**. *Cavia cobaya.* A small rodent animal, of six or seven inches in length, light color and herbivorous; a native of South America. It is considered a delicacy in Italy; the skin is also valuable. The female brings forth from ten to fourteen young at a litter, carries young three weeks, and bears every two months in warm weather. They are very cleanly, and can not endure cold.

GULA. The region of the throat nearest the lower jaw.

GUM. A concrete juice, the product of most vegetables. There are many varieties, all reducible to two kinds—soluble, or true gums, which dissolve in water, forming mucilage, and are insoluble in alcohol; and insoluble, or tragacanth gums, which soften and swell in water, but are not soluble. Fruit trees often exude gum; this is considered a disease, and may arise from the punctures of insects, but, according to some, is also an indication of a poor soil, requiring putrescent manures. Various names, as *Bassorin*. *Arabin*, *Cerasin*, etc., are given to specimens of gum from different trees.

GUM RESIN. A concrete juice, obtained in various ways from plants, partly soluble in water, and partly in alcohol, as gamboge, aloes.

GUTTA SERENA. Blindness, without loss of transparency in the eye.

GYMNOCARPI. The second division of Persoon's *Fungi*, including those that have their sporules in an exposed dilated membrane or hymenium, as *Agaricus*, *Boletus*, *Helvella*.

GYMNOSPERMÆ, GYMNOSPERMS. A class of plants having naked seeds; at present this feature is said to be peculiar to the *Coniferæ* and *Cycadeæ*. Linnæus erroneously made it an order of *Didynamia*. The seeds of gymnosperms are situated in carpels imperfectly closed, the aggregate of which forms the cone.

GYNANDRIA. A Linnæan class, in which the stamens and pistil are consolidated into a column. It consists, principally, of the *Orchidaceæ*.

GYNOPHORE. The stalk on which some ovaria are elevated, as in the passion flower.

GYPSUM. Sulphate of lime. A mineral found extensively in various parts of the globe. It is a constituent of soils, especially peat soils, and is found in sensible quantities in the clovers, some of the grasses, in turnips, and in the dung of animals subsisting on grass and clover. Its chemical composition is water, twenty-one per cent. lime, thirty-three per cent., and sulphuric acid, forty-six per cent. When calcined at a low heat it is deprived of its water and is then known as Plaster of Paris. Gypsum is soluble in 450 parts of boiling water. and in 500 parts of cold water; and a ton of pure gypsum when ground will yield twenty-five bushels of land plaster. Its effect is most marked on soils that are light, dry, and open. On strong clay its effect is not so marked; in fact, the value of gypsum upon any soil can only be arrived at by experiment. On grain the usual application is from 200 to 300 pounds per acre; on grass, clover, peas, beans, Indian corn, and potatoes, from 400 to 500 pounds are often applied, and to the two latter crops, often in combination with ashes. Applied to clover and grass, after mowing, it increases the aftermath, and also the crops the succeeding spring. To grain it is applied at the time of sowing, and to hoed crops it is applied in the hill or drill at the time of planting. A better way, however, would be to scatter it well around the hill at the time of planting. Thus, at the first cultivating, that outside the hill would be covered the greater quantity of moisture would be absorbed, and the whole more equally distributed where the roots could find it. Gypsum is said to attract ammonia from the atmosphere. This, however, is not true except in a sense. Gypsum is soluble in rain-water; rain-water contains carbonate of ammonia. Thus it enters into combination with the sulphuric acid of the gypsum, and sulphate of ammonia, and also carbonate of lime is formed; that is, the ammonia gives up its carbonic acid and takes sulphuric acid, and the gypsum vice versa, according to well-known laws of chemical affinity. In the same way it fixes the ammonia of stables and manure piles, while the action of lime would be to render the ammonia still more volatile. Gypsum is not a manure itself. It is only beneficial in connection with manures, or when the soil contains humus, or is otherwise fertile in organic matter, though the fertility may be locked up from insolubility. The term fix is explained as follows: Supposing the gypsum to meet with a sufficient supply of ammonia in the soil, and that it exercises its full influence, 100 pounds of common unburned gypsum will fix or form sulphate with nearly twenty pounds of ammonia, containing sixteen and one-half pounds of nitrogen. One hundred weight, therefore, (112 pounds,) will form as much sulphate as will contain twenty-two and one-half pounds of ammonia; and, if introduced without loss into the plants, it will furnish them with eighteen and one-half pounds of nitrogen. The sulphuric acid contained in gypsum, from well-known principles, acts beneficially in decomposing and bringing into activity the humus and insoluble matter accumulated in loams or peaty soils. Gypsum is decomposed by carbonate and muriate of barytes, the carbonates of strontia, potash, soda, and of ammonia, as well as by oxalic and humic acids, and where any of the four last named occur naturally in the soil, or are applied by artificial means, new combinations take place, which are attended in some cases with beneficial results. For instance, in order that gypsum may be useful as a fertilizer, the soil must always contain more or less humus, even if it be only two or three per cent. If, however, it contains too much free humic acid, it will decompose the gypsum, so that humate of lime will be formed, and the sulphuric acid will be set free, which may then act as a corrosive on the rootlets of the crops. On this account, a soil very rich in humus must never be manured with too much gypsum, because, though the sulphuric acid were to combine with another base contained in the soil, it would still form therewith a salt easily soluble in water, by which the plants would receive too much sulphuric acid at once. If strewn over fresh dung, and plowed in with it in the field, it will undergo a partial decomposition by the carbonate of ammonia developed from the excrements, so much so that sulphate of ammonia and carbonate of lime are formed. Gypsum, therefore, is known to act chiefly through its sulphuric acid, which, on the one hand, obtains soluble ammonia from the humus constituents of the soil, and furnishes this to the plants at a period when they are especially inclined to the production of leaves and stems; and on the other hand, strengthens and increases the power of plants to absorb ammonia from the atmosphere, and this in greater proportion as these are more abundantly endowed with young and vigorous leaves.

GYRATE. Twisted round in circles.

GYRI. The annular series of scales on the tails of some quadrupeds.

H

HABITAT. The natural abode of animals, plants, etc.

HACK, or **HACKNEY.** In England, a general term for a road horse, which does not always convey any sense of inferiority, or refer to horses let out for hire. It is, however, often used in that sense.

HACKMATACK. The American Larch. (See Larch.)

HAIL. Atmospheric water congealed into ice, either globular or irregular, often measuring an inch across. It is altogether different from snow, in occurring during the spring and summer. Hail is produced only during violent winds, which carry a great deal of moisture into the upper regions of the air, where it becomes solidified by extreme cold. Hence the reason why hail is often found in comparatively narrow areas.

HAIR. Slender tubes of animal matter analogous to horn. It is a non-conductor of heat. Refuse hair ranks as a manure with skin or glue, producing the same results by decay; woolen rags are the most familiar example used in this way. Hairs in botany, are transparent tubes of cellulose inserted into the epidermis; they are totally dissimilar from animal hairs, in containing no nitrogen. Cotton is an instance of hairs attached to seeds, called pappus.

HAIRBIRD. (See Sparrow.)

HAIR GRASS. The genus *Aria.*

HALCYONIDÆ. A family of fissirostral birds, of which the king-fisher is the type.

HALESIA. The snowdrop tree (*H. tatraptera*); ornamental trees introduced and hardy south of forty degrees.

HALHYDRATES. Salts in which the combined water of the acid becomes a component of the salt.

HALOGEN. Bodies which unite directly with metals, without any previous oxidation, and form salts, as chlorine, sulphur, fluorine; their compounds are termed Haloid salts.

HALTICA. A genus of small coleopterous insects. (See Flea Beetle.)

HAM. The thick part of the leg of animals.

HAMES. The wooden or iron collar pieces to which the traces are attached.

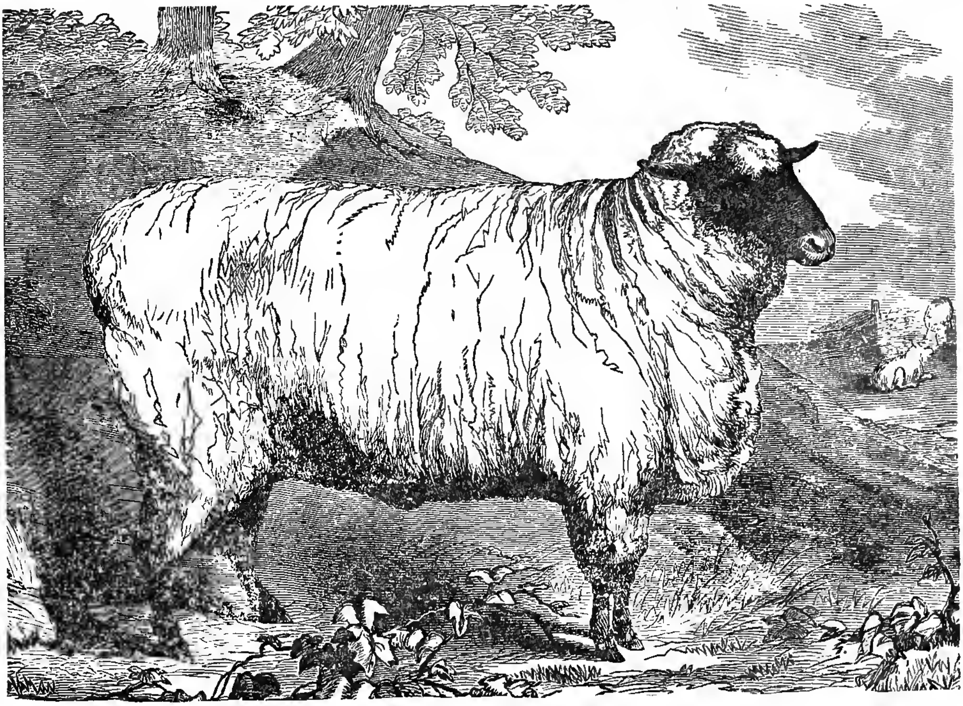
HAMMER BEAM. A horizontal timber from or near, but above the foot of a rafter, acting as a tie.

HAMBURG FOWLS. Hamburg fowls are of a number of varieties, the principal ones being the Black Hamburg, and the Penciled Hamburgs, the latter being divided into Golden and Silver Penciled. Whatever the variety they all have these characteristics. They are of small to medium size, compact, and handsome in their carriage, with bright, firm, double combs, ending at the rear in a long point, turned up. The tail is large, upright, and with long plume feathers. Their constitutions are good. They are good layers, and seldom inclined to sit; the eggs are small, but of delicate flavor. The cut shows a pair of Penciled Hamburgs. That they are an old breed, is evidenced from the fact that Aldrovandus describes it as the Turkish fowl. The white body and black markings, the greenish-black tail, and the blue-tinted legs, show that this old writer had in his mind what now is the Silver-penciled Hamburg fowl. They have long been known in England, as Bolton Grays, Creoles, Creels, Corals, etc., from their markings, and on the continent, also, under a variety of names, showing their wide dispersion and general good qualities. The general character of the Penciled Hamburgs, either silver or golden, besides these already noted, are: In the plumage on the body of the hens, each feather except the neck-hackle, is penciled with several transverse

PENCILED HAMBURGS.

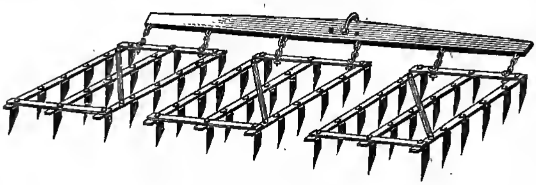
bars of black on a clear ground, white in the silver variety, and a golden red or rather a rich bay in the golden; the hackles, however, being free from dark marks. The cocks have not these marks, they are either white or bay. The legs in both sexes are blue; the ear-lobe white, well-defined, and the face scarlet. The tail of the cocks should be black, the sickle and side sickle feathers glossed green, with a narrow white edging. The tails of the hens are distinctly barred, or penciled with black.

HAMPSHIRE DOWN SHEEP. This English breed is said to have been produced by crossing the South-Down upon the old breed of Hampshire, and subsequently by an infusion of Cotswold blood. This gave them an increase of wool, a larger size, their constitutional and hardiness being retained. It is claimed for them that they are more hardy than the South-Downs. When introduced into the United States, especially in the South, they have given satisfaction, and crosses on Leicester and on Cotswold, are reported to have taken kindly and with profit to both. As a rule, however, the breeder should avoid too great a size, when mutton is an object, since it induces excessive fat, which is not liked, and indeed, is an objection to many of the large breeds. In relation to this British breed of sheep, the well known statistician, J. R. Dodge, in Sheep and Wool of the World, says: This family of Downs, unlike the Sussex, is founded through skillful breeding. It was effected in harmony with the idea of more meat in a shorter period of time—the same which originated the Leicester and the Short-horn—by admirers of the South-Down style, who saw in the size and the early maturity of the Wiltshire horned sheep and the Berkshire Nott, qualities forming an admirable foundation for a breed upon which the fine form and superior quality of flesh of the Down could be ingrafted. It is worthy of notice that a breed which has long displaced the original Sussex Down and other breeds in Berkshire, Hants, Wilts, and Dorset, has been made what it is, in the hands of skillful breeders, by the blood of the finest specimens of the race which they now dominate in all this section. This change is a natural result of the inclosure of the commons, the introduction of artificial manures, and the production of such crops as turnips, rape, vetches, trifolium, rye, and Italian rye-grass. This is one of the facts with which the history of British sheep-husbandry teems, illustrating the necessity of change in breeds, with changed conditions of production or consumption. It is estimated that the weight, both of mutton and wool, has been increased in this region fifty per cent. The statistics of 10,000 Hampshires for three successive years showed the average yield of lambs to be ninety-one per cent., the mortality of ewes five and one half per cent., and of tegs three per cent. per annum. The wool is of fine quality, but short staple, averaging four and one half pounds per fleece. The best specimens of these sheep may be found at the Overton and Weyhill fairs, in Hampshire, and the Britford and Wilton fairs, in Wiltshire. The wether-lambs are now usually sold in the latter part of summer or early autumn, and the ewes are kept three years for breeding. The period of service of rams is from August 1 to the middle of September. In England, the ewes are usually kept on turnips and hay during the



HAMPSHIRE DOWN RAM.

winter, the hay being cut into chaff with a portion of straw, and sometimes seasoned with a little malt-dust, bran or cake. The lambs go out on turnips, if the weather is fine, in a few days after they are dropped, though many farmers keep them penned for two or three weeks. After April 1 they leave their diet of turnips and hay, and go to the water-meadows by day, and are folded at night on Italian rye-grass, winter-barley, or trifolium, the wether-lambs getting a little cake or corn. On farms that have no water-meadows a large supply of late swedes is secured, and the lambs are kept upon winter-growing grasses and forage-plants until the vetches are in bloom. Early in May they are weaned, when it is common to pasture in clover by day and fold on vetches by night. When the vetches are consumed, the sale lambs are supplied rape and cabbages and the ewe-lambs follow to consume what the wethers leave. Thus managed, the lambs attain great size and command high prices. Formerly they were largely sold, from July to September, to go to Kent and Surrey, and other points near London, to be fattened for the markets of that city. They are now so good that they are sold for immediate consumption. It was deemed proper to give somewhat in detail the mode of management in fat-lamb growing, not only to show the practice employed with this particular breed, but to call renewed attention to the necessity of high feeding in this business, and illustrate again the constant variation in feeding and management to meet the requirements of changed or differing circumstances.



ADJUSTABLE HARROW.

HAMS, CURING. (See Pork.)

HAMSTER. *Mus cricetus.* A kind of rat found in the north of Europe, which lays up extensive stores of food.

HAND. A measure of four inches, used in estimating the height of horses. The fore leg of a horse or other animal.

HANGBIRD. (See Oriole.)

HARD WATER. Water containing salts of lime, especially gypsum. It is softened by adding soda-ash or ammonia.

HARE. The family *leporidæ* includes the hares and rabbits. Their well known characteristics are long and erect ears; large prominent eyes; four incisors in the upper jaw, and two in the lower, the two middle ones in the upper jaw much the largest; hind legs long, and adapted for leaping; fore feet five toed, hind feet four toed; tail short or wanting. The gray rabbit is a hare and one of our most common species, doing great damage to gardens, and especially to nurseries and young orchards in winter, by barking the trees. They are easily trapped under a dead fall, or common, dark, box trap, by means of the ordinary figure four set of sticks.

HARICOTS. (See Bean.)

HARL. The refuse skin of flax and hemp.

HARLAN'S BUZZARD. (See Buzzard.)

HARPALUS. A genus of predaceous beetles. (See Beetles.)

HARRIERS. A breed of dogs used for hunting hares.

HARROW. A frame generally square or A-shaped, filled with teeth, used for the purpose of breaking down lumps, mellowing the ground, covering seed sown broadcast, and in destroying young weeds in cultivated crops. Among the later improvements in harrows for special purposes are the revolving and the smoothing harrow. The revolving harrow is so hung that upon being drawn forward, the frame in which the teeth are placed revolves, thus stirring the earth to a considerable depth. It frees itself of trash perfectly, and is a most useful implement. The smoothing harrow has the teeth slanting backward at a greater or less angle. Its work is superficial, but it is an excellent implement among young weeds and in cultivating crops. The cut shows one of the modern forms of the square harrow, the teeth of which may be made to slant back at will. The harrow will always be valuable however, for breaking up, and at the same time consolidating the lower surface of plowed soil. The drill and also superior modern pulverizing implements have, in a measure, superseded its use. It is, however, still indispensable on all farms.

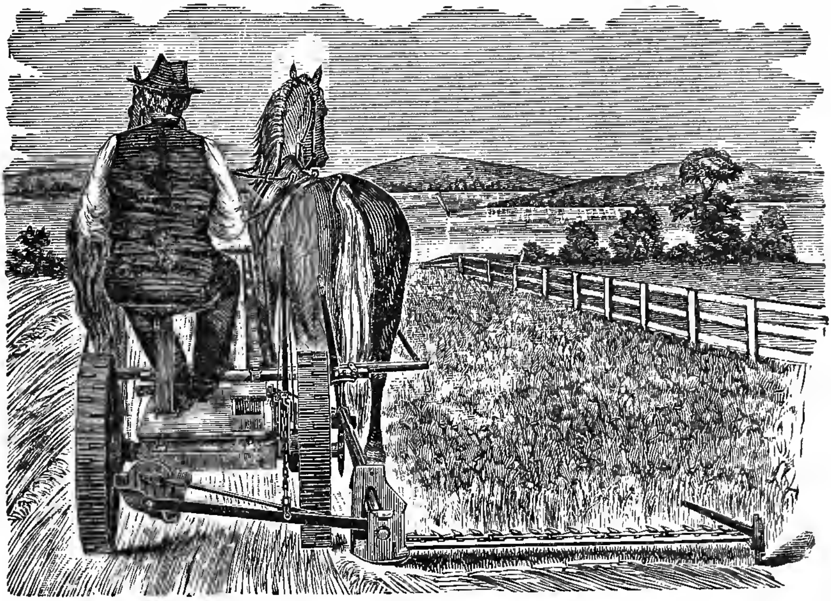
HARTSHORN SPIRIT. Solution of ammonia. (See Nitrogen.)

HARVEST FLY. (See Cicada.)

HARVESTING. Harvesting is one of the most important labors of the farm, and must be attended to at the proper time whatever else may be in the way of the farmer. For this reason a diversity of crops, excessive hurry in this labor by extending it over a greater length of time than must otherwise ensue. Thus winter wheat, rye, spring wheat, barley, oats, and flax may succeed each other, and with the aid of improved harvesting machines, all may be secured in good condition, unless the season be extremely wet. The proper time of harvesting wheat has long been a mooted question, millers still contend that it should be cut when in the dough state, and there is no doubt but it makes more fine flour to the bushel of sixty pounds than does a bushel of perfectly ripe wheat. Nevertheless the yield per acre is less, the straw is harder to cure, and the price given no more per bushel, in our great markets. In harvesting the farmer is guided by the profit to accrue to himself, not to the miller. When the crop is large, the harvest must often necessarily begin early, and continue until the crop is dead ripe to secure all the crop. Hence the farmer must manage the harvest according to circumstances. The best time to cut wheat, all things considered is when the stalk is yellow half way up the stem, and the grain just out of the dough state and fairly hard. The straw is then valuable if well cured, and the grain in condition to dry out without shriveling. All the other grains, rye, barley, oats and flax should not be harvested before this time. Buckwheat is harvested just at the time of frost, or else when there is a maximum quantity of seed ripe, since this plant continues to grow, blossom, ripen, and drop its seed until killed by frost. Corn may be cut up at any time after the kernels are, glazed, or out of the milk, the best time is after the grain is out of the milk and while yet the leaves are green, since the only reason for cutting up corn is to save it from frost or for the value of the fodder.

HARVESTING ICE. (See Ice Harvesting.)

HARVESTING MACHINERY. It is little more than thirty years since the first harvesting machinery was put into successful operation For years the work was not successful, until repeated failures, amended by improvements, resulted in the self-raking harvesters, and these again gave way to the self-binding reapers. It may now be safely asserted that harvesting machinery has nearly reached that perfection which human ingenuity may give it. In the harvesting of grain, the best machines cut the grain clean, and of uniform height, even when lodged, deliver it to the automatic binder, which binds and flings the sheaf on a platform to be dropped on the ground when the full number required for the shock is completed Thus, there is no gleaning, and the bundles are so evenly and tightly bound that there is little possibility of their losing straw or coming unbound. In the making of hay, in addition to machines that will cut at any desired height from the ground, the hay tedder aids in catching weather. The horse hay-rake first places it in windrows, and then into rough cocks. The hay sweep carries it, half a ton at a time, to where it is deposited on the stack by horse power. If the hay is to be carried long distances, the hay gatherer takes it from the windrow and carries it to the top of the load, and at the barn, the hay carrier conveys it from the wagon to any part of the mow. Thus, we have almost the perfection of economy in the making and harvesting of hay. Not only in the cheapness with which it is made but also, in the excellence of quality of the cured hay. It may be safely estimated that harvesting machinery has more than quadrupled the area of hay and grain, that may now be taken care of per man, over what could be done forty years ago. In newly settled districts, where help is difficult to be had, it has enabled vast areas to be yearly sown, without which machinery, these tracts would for many years have remained only partially cultivated.



MOWING.

HASTATE. A descriptive term in botany; halbert-shaped.

HATCHEL. A carding comb or hackle.

HAUSTELLATES. Insects furnished with a proboscis for suction.

HAWK. The genus *Falco*. (See Buzzard.)

HAWTHORN. *Cratægus oxyacantha*. Probably every person who has thought about plants for hedging, has had a longing desire for the English Hawthorn, from the associations in his mind in reading about the beautiful hedges of England. Whatever it may do there, it is not adapted to hedging in the United States, especially in the West and South. Our common Buckthorn (*Rhamnus catharticus*) has also been tried extensively. Neither of these are of value agriculturally, except as specimen plants in large collections.

HAY. The hay crop of the United States is one of the most valuable in the list of agricultural products. Hence the necessity of making and saving it in the best possible manner. So difficult is this in moist climates, as in England, that various expedients, as constant stirring, after it is cut, and even artificial drying is resorted to. Tedding by machines or by hand, is indeed quite common in the Atlantic States, and is not unknown even in the West. Throughout the whole prairie region, however, the dry, hot weather usually enables the farmers to get up their hay in good condition, and in a state of greenness, as to color, unknown further east, and impossible in the climate of Great Britain. The hay is usually cut in the morning and laid into windrows, or cocked in the afternoon, from whence it is often drawn immediately to the stack or to the barn. It is not generally known, but is nevertheless the fact, that hay can be put into a barn much greener than into a stack. The reason is that in a stack there is easier access of air, and air and moisture favors the heating and fire-fanging of vegetable substances. In a mow the moisture ultimately finds its way to the top, which will sometimes be quite wet, while the body of the mow remains intact. The putting of hay, however, into the stack or mow in a damp state, is both in theory and practice to be reprehended. Under peculiar conditions of the atmosphere, hot, close weather, or continued moist weather, will cause the hay to heat unduly. sometimes to such a degree as to cause it to take fire. In England, this is not a very uncommon occurrence. The proper way is, if the hay shows signs of dampness in the cocks, and the weather is not such that it will become thoroughly dry in pitching on the wagon and into the stack, to spread the heaps, somewhat, an hour or two before hauling. If the weather is fine the hay will undergo a sweat in the heaps, and in two or three days come out perfectly cured. The same remarks will apply to grain. It should never be stacked until thoroughly dry. However dry either hay or grain is put into the stack or barn, it will always undergo a sweat. This usually lasts from one to two months, until the mass again becomes dry, when it will be found—if properly cured before putting away—to be perfectly sweet, with a pleasant odor, free from the dust of mold; and it will then keep intact indefinitely. During the progress of this sweat it should not be touched. Grain will thrash tough at this time, and hay is not fit for feeding until it has undergone this sweat. Thus, intelligent stablemen will not buy new hay, preferring to feed old hay until about the first of September or October. During this sweat hay will lose weight, ranging all the way from ten to twenty per cent., losing the former amount if put into the mow in proper condition. The yield of hay made from the cultivated grasses and clover, on good land, should be from one and a half to two tons per acre. The average product North will be far below this. Rhode Island produces the smallest average yield per acre, 80-100 of a ton; Oregon produces the largest average yield per acre, 1.45 tons; Iowa comes next with 1.42; then Illinois, Wisconsin, Nebraska and Minnesota with 1,40; Nevada, California and Missouri come next with 1.35 tons; and Michigan 1.30 tons per acre. All the other States fall below this. Even New York, with her superior cultivation, only reaches 1.15 tons per acre. Curiously enough, some of the Southern States present good averages. Thus, Virginia and North Carolina give 1 25; Georgia, Alabama, and West Virginia give 1.30; Mississippi, 1.35; Tennessee, 1.36; Texas, 1.38; and Arkansas, 1.40 tons per acre. It may be interesting to know that the hay crop of the United States, was about 31,000,000 tons in 1876, worth about $370,000,000. In 1877 it was 31,629,300 tons, worth $271,934,950. This was the product of 25,367,708 acres. The same year, the corn crop of the country aggregated 1,342,588,000 bushels, from 50,369,113 acres, worth $480,643,400. In 1879, there were 35,493,000 tons of hay made in the United States, from 27,484,991 acres, valued at $330,804,494, an average yield for the whole country of 1.24 tons per acre, worth an average of $8.60 nearly per ton, or an average value of $10.72 per acre. Thus, the reader will see that the hay crop of the country, acre for acre, exceeds considerably in value that of Indian corn. In 1878 the yield of hay exceeded that of 1877 not so much in acreage as in average yield, bringing the hay crop of the United States, in 1878, up to about 38,000,000 tons. The cutting, curing, and stacking of hay cost, in the New England States in 1869, an average of $4.51; in the Middle States, $3.76; in the Southern States, $3.22; and in the Western States, $2.93 per acre. With improved machinery and implements, the cost of making hay in the Western States need not exceed seventy-five cents per ton. We have seen it put into the cock for forty-five cents per ton, including cost of wear and tear of implements, and we once put forty-eight tons in the stack at a total cost of sixty-three cents per ton; the average yield being 2.25 tons per acre, the pitching on and off the wagon being done entirely by hand, and the haul averaging one quarter of a mile. It is considered that the produce of permanent meadows is more nutritious, ton for ton, than that of temporary meadows, mown only for a year or two in the regular rotation. This is particularly true of pastures. So also it is known that hay made from young grass is more nutritious than that made from grass nearly ripe. In practice, it has been found most economical to cut hay just after it has gone out of blossom, or, as it is termed, when in the second blossom, that is, just when the later heads are in blossom, This is from the fact that at this time the head and stalk contain its maximum of digestible matter, which decreases as the plant gets older, and accumulates more and more woody fiber. Below we give a table showing the composition of good pasture grass and meadow hay, and immediately following, a table showing the composition of clover and clover hay.

	Grass.	Meadow hay.
Water	68.23	14.61
Flesh-producing or nitrogenized substances	4.86	8.44
Fat-producing or non-nitrogenized substances	11.45	42.63
Woody fiber	12.60	27.16
Ash	2.86	6.16
	100.00	100.00

	Red clover.	White clover.	Clover hay.
Water	80.65	83.65	16.50
Flesh-forming substance	3.60	4.52	15.81
Fat-producing matter	13.78	10.26	37.63
Woody fiber			22 47
Ash	1.97	1.57	7.59
	100.00	100.00	100.00

On comparing these results with those of the analysis of the grasses before quoted, we notice that while the general composition is much the same in both cases, the clover contains, on the whole, more water, and at the same time more albuminous or flesh-forming principles, than the natural grasses. (See Supplement.)

HAY TEA. The infusion made by pouring boiling water over hay; it is one of the best known means of recovering weak animals. It will replenish the udder of cows, cause horses to urinate freely, and assists assimilation of food.

HEADLAND. A term applied to the lands or ridges in fields, on which the plow turns, or upon which the team turns in cultivating them. Headlands should not be allowed to gain in height by frequent plowings one way.

HEART. The central hollow muscle which receives the blood and drives it over the system. The heart is divided into two ventricles.

HEART WOOD. Duramen. The central, old, and colored wood of trees; it is the most durable.

HEAT. Agriculturally considered, heat is the force through which plants are enabled to grow and perfect their seed. In connection with this, however, there must be moisture, and with moisture substances soluble in water proper to the sustenance of the plants. Thus under a given heat, or an average heat, extending through a certain period, we have the ripening point of the various crops cultivated for the use of man. Nevertheless heat and cold are merely relative terms. Thus, if we immerse one hand in cold and the other hand in warm water, and then successively in water of a medium temperature between the two, this water of medium temperature will feel cool to the hand taken out of hot water, and warm to the hand taken from cold water Again, the temperature of the body in health is constant, being about ninety-six degrees. When the temperature is much below this point, or when the body is suddenly cooled from artificial causes, we feel the sensation of cold. If, on the other hand, insensible perspiration is obstructed we are uneasy from the accumulation of heat, the act of perspiring being the natural refrigerating process among animals. In expansion by heat wood is found to do so chiefly in a direction transverse to its fibers, and but little in length. On the other hand iron expands in the direction of its length to such a degree as to force apart walls, when rigidly placed, and railway bars, unless spaces are left between, will expand to so great a degree as to be sometimes forced up in the shape of a semicircle. Again, the contraction of bodies upon cooling is often not so great as their expansion. Thus we find old fire grates, and iron when it is often strongly heated, much distorted. Heat is communicated in various ways, through particles in bodies, generally in two ways; in solids, by passing the heat received from particle to particle. This is called conduction. In fluids heat is communicated by being carried connectively, that is, the heated particles rise by their increasing levity through heat, conveying the heat and giving it out to other parts. Thus water heated from above, remains comparatively cold at the bottom, but heated from below the whole body comes to be of nearly a uniform temperature. In wood the heat conducting power bears no definite relation to its density. Thus birch one of the lightest of woods, conducts heat better than any other; oak, a very dense wood, conducts nearly as well, but iron-wood, a wood of great density, is a bad conductor of heat. Thus we see why some vegetable substances seem colder than others. Again, the conducting power of a medium has much to do with the sensible heat experienced. Thus, a metal heated to 120° may burn the hand, while immersed in water without motion at 150° it may not scald. So, also, air heated to 300° has been borne by the human body without injury. Feathers, down, wool and cotton, are bad conductors of heat. Hence their superior warmth as clothing because they prevent the escape of heat from the body. The order of their value in capacity being, furs, wool, cotton, silk and linen. The rays of the sun striking the earth produce sensible heat; part of this is absorbed by the soil, and part reflected back into space. The relative powers of absorption may be represented by lampblack at 100°, common glass will absorb about ninety degrees, and a highly polished metallic surface will absorb but six degrees. Therefore, practically a dark soil will absorb much more heat than a light one The relative power of soils to absorb heat giving the maximum temperatures of various earths exposed to the sun, both moist and dry, the thermometer 77° in the air, was found by Becquerel, to be as follows: the difference in temperatures between moist and dry being due to the heat spent in the evaporation of a portion of the water of the moist earth, an important point for the farmer to note in periods of intense heat.

Kinds of earth.	Maximum temp. top layer.	
	Moist earth.	Dry earth.
	Degrees.	Degrees.
Silicious sand, yellowish gray	99.05	112.55
Calcareous sand, whitish gray	99.10	112.10
Argillaceous earth, yellowish gray.	99.28	112.32
Calcareous earth, white	96.13	109 40
Mold, blackish gray	103.55	117.27
Garden earth, blackish gray	99.50	113.45

The following table, also from Becquerel, gives the relative retention of heat by different soils, that of calcareous sand being one hundred, and also the time of cooling from 144°.5 to 70°.2, the temperature of the surrounding air being 61°.2, of eighteen feet cubes of the same size of the different earths:

Kind of earth.	Capacity for heat.	Time required.
		h.
Calcareous sand	100.0	3.30
Silicious sand	95.6	3 27
Argillaceous earth	68.4	2.24
Calcareous earth	61.8	2.10
Mold	49.0	1.43

Another noteworthy agricultural fact in relation to heat is, the amount of heat which falls upon a given surface depends upon the inclination to the different points of the horizon. A field, for instance, in latitude 40°, sloping toward the south, receives a greater, and one toward the north a less amount of heat; moreover, the former obtains more than an equal extent of ground parallel to the horizon, and the latter, as in the other case, much less. A field, also, which slopes in an easterly direction receives less heat than another inclined toward the west, inasmuch as more reaches the latter, since the maximum heat of the day takes place after the sun has passed the meridian; as it is, each of these enclosures gets a less amount than one of equal extent parallel to the horizon. A certain degree of heat is required to bring the sap of plants into active play, just as a certain amount of heat is required to produce germination in seeds, and each species of plants has its own determinate degree of mobility of sap or germination, as respects the seed. (See Germination.) Thus vegetation is accelerated and becomes luxuriant in presence of its maxima of heat, acting upon rich earth in connection with moisture. Hence, we see gardeners forcing plants out of season by means of heating material, in connection with glass structures, or by means of hot-beds and cold frames, and even by the protection of hedges, fences, and belts of timber. In relation to the heat of the earth, Pouillet, from many observations, gives the following deductions: The diurnal variations are not perceptible at depths greater than about forty inches. The mean annual temperature of the different strata differs little from the mean annual temperature of the air. The differences between the maxima and minima of the different strata decrease in a geometrical progression, while the depths increase in an arithmetical progression. From all the observations it appears that, at a depth of from twenty-six to twenty-nine feet, the annual variation is only 1°.8 Fahr.; at from forty-nine to fifty-two feet, it is but 0°.18 Fahr.; and at a depth of from sixty-five to eighty-one feet, it becomes only 0°.2 Fahr. At the depth of about twenty-six feet, or where the variation is 2° Fahr., the seasons are precisely reversed; that is, the maximum temperature occurs about the 1st of January, and the minimum about the end of June. In animal tissues heat is generated by the food we eat and the exercise we take. In vegetables chemical action produces but little heat, the heat of vegetables being principally due to the heat surrounding them and their varying powers of conducting heat. The following observations, collected from various sources, will show the researches that have been made from time to time in this direction: In the tissues of living bodies a multitude of chemical processes are constantly going on, engendering a certain heat, which in warm-blooded animals constitutes their temperature proper. But in cold-blooded animals and in vegetables, this chemical production of heat being very feeble, the temperature which they have comes principally from the ambient medium; not only from the air but also from the water, charged with different elements, which is sucked up by the roots in order to form the sap. Like that of the air, the temperature proper for vegetables is submitted to periodical variations, only its amplitude is much less extended. This heat is liberated in the leaves, organs of respiration, in the flowers, organs of generation, as well as in the green parts of vegetables. In the phenomena of nutrition, the ascent of sap can not be effected without a slight production of dynamic heat, nor afterward can its elaboration in the leaves, under the influence of light, take place without chemical reactions, and consequently without another liberation of heat. In fine, the whole of these chemical reactions are always accompanied by the production of heat, whose influence upon the vital functions of the plant we have not yet been able to appreciate. This estimation becomes the more difficult, as the production of vegetable heat is accompanied by many effects of cooling, such as evaporation from the leaves, liberation of oxygen, arising from chemical reactions which take place under the influence of light, and from which results a disengagement of carbonic acid. The first experiments undertaken to determine the temperature of the internal parts of vegetables do not go back much beyond eighty years. At that time thermometric observations did not possess that degree of exactitude which they have since acquired. None of the precautions necessary to protect the thermometers from atmospheric influences were then in use. Hence resulted a multitude of errors concerning the true nature of the internal heat of vegetables. In the first place Hunter's experiments, made in 1775, upon a walnut tree, by means of a hole which he had bored in it, in an obliquely downward direction toward the center. The sap of the walnut, which flowed abundantly, was frozen at 0° when it was drawn from the tree, although the temperature of the latter was lower. Why does the sap, he asked, preserve its fluidity in its natural channels much below zero? He cites the property possessed by water of freezing more easily when in a considerable mass, than when it is found in capillary spaces, where the attraction exerted by the sides upon the liquid molecules opposes their solidification. Indeed, Senebier has seen water remain liquid at 7° below zero in capillary tubes, with a diameter greater than that of the ducts of plants. Neuffer and Schübler have found that trees freeze with more difficulty, as their layers are closer. This circumstance contributes to give vegetables the power of resisting a high degree of cold. Rumford and Leslie have also made the observation that air being a bad conductor of heat when its molecules can not be displaced, must be the best envelope we can take to oppose refrigeration. It seems to result from this that the more layers possessed by vegetables the better ought they to resist cold. Such is the case with plants having a large number of epiderms, as the birch, which attains the highest elevation in the Alps, and advances farthest into the polar regions, and as the horse-chestnut tree, which flourishes in the tropical regions. Numerous observations have been made by Pictet and Maurice at Geneva, from 1796 to 1800, upon a horse-chestnut tree, in the trunk of which a hole had been bored on the north face to receive a thermometer. The results were as follows: During the five years from 1796 to 1800 the annual mean temperature of the air on the north side was sensibly equal to that of the tree. The annual difference between the two means being only 0.04 of a degree, we may infer that the mean temperature of the tree was strictly equal to that of the air. The difference between the monthly temperatures of the air and those of the tree was more or less sensible according to the season. During the winter months the temperature of the earth at a little over four feet below the surface of the ground is higher than that of the tree; in spring, it is the reverse. In summer, according to the year, the temperature of the earth is higher or lower than that of the tree; and in autumn it is always higher In general, it is toward autumn the temperatures are nearly equalized, but varying with seasons. Although the mean temperature may be the same in the air and in the tree, nevertheless, the variations that are met in the tree are much less than those in the air; the tree, therefore, preserves longer its acquired heat within limits depending upon its diameter. Another important fact shown by the Geneva observations is that the maximum of temperature in the air, according to the season, takes place from two to three o'clock p.m., while in the tree the temperature continues to rise, however feebly, from two o'clock until sunset, when the observations were ended. Thus the maximum in the tree appears later than in the air. Moreover we need only take the mean of the tree's temperature at sunrise and sunset in order to obtain almost exactly the mean temperature at two o'clock. During the three years, 1796, 1797, 1798, the variation of temperature through the night, in the air, was at a mean of 3.42, and in the tree of 0.73; that is to say, 4.69 times greater in the first case than in the second. In 1826, Halder advanced the assertion that trees are sometimes found in winter at a temperature below the freezing point, and pass even to a congealed state without injury to their vitality. The thermometer had descended almost to—15°, and —17°.07 in some young trees, without hindering their vegetation. Halder attributes to evaporation the lower degree of temperature observed in the tree. Rameaux has reached the following conclusions:—The temperature at any altitude at the center of the trunk of a poplar tree increases during the day and diminishes during the night; always differing in one section from another, according to the thickness. Before sunrise, and even for some time afterward, the central temperature decreases from the foot of a tree to its top. The contrary takes place during the rest of the day.—In the daytime, the temperature of a section is carried as far beyond the temperature of inferior sections as the ambient heat is stronger. These differences reach their maximum about sunset, after which they diminish gradually, are effaced little by little, and end by taking contrary signs.—During the night the temperature of any section was so much higher than that of the sections situated over it as this was lower than the ambient temperature. The differences reached their maximum toward sunrise, after which they diminished very rapidly, ending by taking contrary signs. In the morning, before sunrise, the central temperature of the tree in its four sections was inferior to that of the ground at the mean depth of its roots; during the day it was the contrary. Rameaux finally reached the following conclusion: Atmospheric heat, if not the sole source, is so predominant a cause of vegetable temperature that its effects weigh down all the other causes put together. Whence it follows that the temperature of a tree must, in each section, increase from surface to center during the daytime, when the ambient heat is highest; it must diminish, on the contrary, from centre to surface during the night. The author, nevertheless, believes that the temperature of the ascending sap must exert some influence equally with that of the air. In the polar regions we observe the same facts. The experiments made by Bravais, at Bossekop, and by Thomas, at Kaafiord, in the winter of 1839-40, have proved that heat follows in the interior of pine trunks the curve of the temperatures of the air, with a retardation of eight to twelve hours When the diameter of the tree was increased the retardation was greater. We can conclude from all these experiments, adds Becquerel, that cold penetrates to the heart of living trees, as to that of dead ones; that in the living pine the temperature throughout the greatest cold is a little more elevated, either because the sap sometimes rises even through mean temperatures of the air inferior to zero, and heats the interior of the tree by becoming congealed, or because the heat of the ground being superior to that of the air, gives the sap a portion of its proper heat. According to Becquerel, the observations hitherto collected upon the temperatures of vegetables, lead to the following consequences: The annual mean temperature of vegetables is the same as that of the air; the two curves of temperature have the same appearance, although not coincident throughout, considering that trees only participate in the diurnal variations of the temperature of the air in proportion to their diameters. The air is, therefore, the principal source of vegetable heat. The maximum of temperature in the air is reached in winter about two o'clock in the afternoon, and in summer about three o'clock; in vegetables these hours are delayed according to their bulk. In trees with a diameter of three or four décimètres (twelve to fifteen inches) the maximum occurs in winter about nine o'clock p.m., and in summer about midnight. When the temperature of the air sinks below zero, vegetables resist for a longer or shorter time this cooling, as well as the heating which follows a thaw, without being due to the bad conducting properties of the wood. When the cold continues during many months, as in the north of Europe, the temperature in the tree is successively lowered, but never as far as in the air. There is a difference of from one-half to a degree. The temperature of vegetables, which is almost wholly derived from without, appears, nevertheless, to be influenced by the heat liberated in chemical reactions in the tissues, and by the temperature of the soil from which their roots extract liquids to form the sap. We are still ignorant how, in winter, when the upward motion of the sap is almost suspended, the underground temperature may diminish refrigeration, although the external temperature is below zero. Trees exposed to solar and to nocturnal radiation, during the day and a great part of the night, heat the strata of air with which they are in contact, and cool them when the leaves have taken the temperature of the air before the sun has yet appeared. But its cooling effect is small under the latitude of Paris, at least during the spring, at which time the observations were made. Woods and forests probably exert the same influence, varied by divers causes; but they really act as repositories of heat when the trees receive the direct rays of the sun, which is principally from May to October. The air, as a transparent body, only stops a small part of the solar rays in their passage through it. These rays then proceed to opaque bodies, the earth, and to plants, which absorb a much more considerable part of them. Solar heat is, therefore, one of the principal elements which distinguish agricultural climates as they receive it more or less abundantly, either by reason of latitude or altitude of the localities, protection from winds, the exposure, or the topographical character of the soil, and of a multitude of atmospheric agents which reflect or intercept the solar rays. As an effect purely local, science at first neglected it; but the savants were not slow in perceiving the enormous influence of this solar heat upon the progress of vegetation, maturity of fruits, etc. Humboldt did not cease to remind us that solar effects must be studied in order to account for vegetable phenomena, and the Academy of Sciences of Paris has made it a subject of its recommendations to travelers. In 1840 Gasparin made some experiments upon three mulberry trees of the same variety, the first receiving full solar rays, the second receiving them only till noon, and the third kept entirely in the shade. The solid matter of the leaves of the first had a weight equal to 0.45 of the whole leaf, that of the second 0.36, and that of the third 0.27. In 1852 he cultivated beans on a plat of ground divided by a partition which shaded one-half of it from the solar rays. After drying, the plants from the south weighed 0.581; the same number of plants grown at the north, although much more developed in height, 0.337; but it was especially in their fructification that the difference was remarkable; the southern plants had one hundred and thirty-one pods, the northern only forty-seven. It is impossible, adds Gasparin, to attribute these results to a simple augmentation of heat; light enters into it for the most part, combining its influence with that of caloric. Indeed, in this experiment the plants had received in eighty-four days a sum of 1,286°.50 of atmospheric heat and only 255°.71 of solar radiation. Certainly an addition of 3°.07 of obscure heat received each day in a greenhouse could not have produced such results. The incontestable effects of radiation upon vegetation struck De Saussure, the great observer of the Alps, and he sought to estimate it by means of experiments upon heat condensed at the bottom of a glass box. Pouillet has estimated the quantity of solar heat which reaches the limit of the atmosphere at 1°.7633 per minute. By supposing the sun at the zenith, he has found for Paris the mean 0.7390 as the number of rays which reach the earth. Forbes has found in Switzerland 0.680, and Quetelet, at Brussels, 0.615. But what is especially important to know, for agricultural practice, is the quantity of solar heat which strikes opaque bodies and accumulates there, by the great principle of conservation of forces, together with the variable state of the temperature of these bodies exposed to the sun, on different days of the year and different hours of the day. When we see solar radiation produce effects so diverse in opaque bodies according to their nature, volume, figure, color, etc., we see how difficult it is to know what happens in each structure of the vegetable kingdom. Thus wheat struck by the sun acquires a temperature different from that of grapes or melons; the leaves, a temperature other than the stem, flowers and fruits; the parts dry or deprived of life become warm very differently from living bodies, whose surface constantly transpires, and whose heat never much surpasses that of the surrounding air. Another mathematical and astronomical question which must be taken into consideration, is, that the sun strikes the earth's surface more or less obliquely, and acts upon it according to the sines of the angle of incidence, and, while ovoid bodies are fully affected by these changes of inclinations, spherical bodies are not at all. We, therefore, perceive what importance this capital question has in regard to the amount of solar radiation received by the soil, by leaves or fruits, according to their extent and form, relatively to the law of the sines of the angle of incidence. A late report of the chemist of the Department of Agriculture, Washington, gives some facts in relation to loss of heat by radiation and the influence of water by evaporation, from which we gain the following: If we examine the tables showing the difference of the temperature of the air and the dew-point, we find that it varies widely with the relative proportion of moisture in the atmosphere. Thus, when the relative humidity is seventy and the temperature of the air is 70°, the difference between the latter and the temperature necessary to the formation of dew has been found to be 10°. When the relative humidity is fifty and the temperature of the air 73°, the variation becomes 20°; while if at the same air temperature the relative humidity be forty-three, the variation will be 25°. With the relative proportions of moisture here given, and with higher temperatures, these variations become still wider. We see, therefore, that during the dry weather that often occurs during the summer months, vegetation suffers not only from deficient moisture to supply its demand, but also from very much wider variations of temperature due to radiation. Indeed, it is during the prolonged summer droughts that we generally notice the heaviest dews. Now, let us see what will be the temperature to which the plant must be subjected in consequence of this reduction due to radiation. Wells found that a thermometer laid upon a grass-plot on a clear night sank sometimes 14° lower than a similar thermometer suspended in free air at a height of four feet above the grass; and the observations of Pouillet seem to show that the diminution of temperature attending the production of dew is at all times sensibly constant at about the figure determined by Wells. Our summer-night temperature usually varies between 70° and 85° Fahr. With the reduction which must take place when the relative humidity is seventy, we will have temperatures ranging from 60° to 75°; with the relative humidity of fifty we will have temperatures of 50° to 65°, while with the relative humidity of forty-three, which could, of course, occur only during very dry weather, the temperature would fall from 45° to 60° Fahr. But these are considerably below the lower limits of temperature at which it has been found by careful observation the movements of protoplasm and the transformation of plastic material can take place, and which, for even half hardy plants as the *Phaseolus* (bean) and *Zea mais* (corn), is stated at about 61° Fahr. The lower limit for the more tender plants is doubtless much higher than this, so that it is easy to see how they may suffer and become debilitated by the cold of summer nights. But the germination of fungus spores and the growth of mycelium, may take place at a much lower temperature and during the temporary interruption of the transformation of plastic material, which must occur at the reduced temperatures mentioned. The mycelium of the germinating spore may effect penetration through the epidermis of the plant into the cellular tissue beneath, where it may feed upon the dormant protoplasm, which is already fitted for assimilation. This result having been arrived at, the recovery of the plant from the abnormal condition produced by the reduced temperature, which would otherwise take place, will be prevented, leaving the plant in condition favorable to the rapid growth and spread of the fungus even to the death of the plant. But while the discoveries of Wells and his colleagues showed under what condition radiation of heat from the plant into space and the production of dew could take place, they also showed how it could be prevented, and in this they give us a remedy for one of the possible causes of mildew and rot. They found, what is familar to all, that dew is not formed on cloudy nights nor in sheltered positions. Indeed, one of Wells' experiments to show that the radiation of heat took place, and that the formation of dew went hand-in-hand with it, was to arrange a board or piece of pasteboard on props and note the temperature and the production of dew in the grass below it and on some cotton wool on the top of it. He found that beneath the cover no dew was produced, and there was at the same time no reduction of temperature. In relation to the second cause of reduction of temperature, evaporation, we have seen how debilitation of the plant, due to an interruption of the vital processes by cold, may be produced. Quoting again from Sachs, we find that in the aërial parts of plants transpiration is an energetic additional cause of loss of temperature, inasmuch as water in the act of evaporation withdraws from the plant the amount of heat necessary to its vaporization, and hence makes it colder. If water upon a leaf be allowed to evaporate slowly, no injury results; but, if a current of dry air of average temperature, or even warm air, be caused to pass over it, a reduction of temperature will take place often greater than will occur in the production of dew.

HEAVES. This is a disease of the organs of breathing, caused by the rupture of the air cells, so the animal can not expel the air without a double effort. It is an unsoundness, caused by hard work especially on a distended stomach, and is aggravated by bad food, especially musty hay and grain. The disease is incurable, but may be palliated by feeding on sound, clean winnowed grain, with but little hay, and that entirely free from dust. The animal should be given but little water at a time, and should be allowed to stand an hour after feeding before being driven. Mild cases may be cured by a summer's run on the prairie, where resin weed (*Silphium laciniatum*) abounds. If to this be added each day for ten days, and then omitted for ten days, and so continued, the following prescription will much assist: One ounce of Fowler's solution of arsenic, one drachm extract of belladonna, and one-half drachm tincture of ginger, mixed with a pint of water and given at a dose.

HECKEL. An instrument for separating the fibers of flax and other fibers.

HECTIC FEVER. A fever occurring in debilitated persons, and also in animals, particularly the horse.

HEDGEHOG. The name of a genus of useful insectivorous mammals, (*Erinaceus*), of service to the farmer by destroying worms, slugs, and insects. They hybernate during cold weather in holes in the earth.

HEDGING. (See Fencing.)

HEELS, ECZEMA OF. (See Grease.)

HELIOTROPE. *Heliotropium Peruvianum.* This genus of plants, of which there are now many varieties, including of late some applicable to bedding, have no merit as to their foliage, but are cultivated for their peculiar and delicious perfume. From a supposed resemblance, in the bloom, to the odor of cherry pie, they have even been called, by some, by this name. The scent, however, comes nearer to vanilla, which again is the extract of an orchid. They are all green-house plants, but do well in the border, in the North, after the middle of June, if protected from wind, giving an abundance of bloom in the summer and early fall. In winter the plants should be kept in the house, rather dry, and when re-potted the tops should be brought into shape, and the roots somewhat reduced. When trained against the wall of a conservatory or green-house, the plant may be kept almost continually in bloom summer and winter, and increasing in growth yearly. Also a silicious mineral of a green color, with red spots; bloodstone.

HELIX. A genus of shell animals, including the garden snails; they are injurious to herbage, and may be kept off by sprinkling with lime, or destroyed by hand picking.

HELLEBORE. A genus of plants remarkable for their purgative properties. *Helleborus fœtidus* is a native of the United States; they are very dangerous and uncertain drugs, but useful as insecticides.

HELMINTHOLOGY. History of worms.

HELOPIDÆ. A family of heteromeran, coleopterous insects. Some of the species infest the bark and roots of trees.

HELVE. A handle.

HEMATITE. Iron ore.

HEMATOSIN. The red coloring matter of blood.

HEMATOXYLON. The red dye extracted from logwood.

HEMELYTRA. The wings of hemipterous insects; the upper wing-cases, half of which only is coriaceous, the rest being delicate.

HEMEROBIANS. Short-lived insects of the neuropterous class, resembling the May fly; they lay their eggs on plants, and the larvæ devour plant lice, and thus subserve the purposes of the pomologist.

HEMIGAMOUS. A descriptive term, meaning that one of two florets in a spikelet is neuter.

HEMIPTERA. Insects having four wings, the upper pair of which is only half coriaceous, or which are half horny and half membranous; they are haustellate. The larvæ have six feet, and resemble the imago; after a few moltings they increase in size and acquire wings.

HEMLOCK. 1. *Conium maculatum.* An umbelliferous plant, with perennial roots, flowering in July; branches much spread and dotted, leaves very compound. It is narcotic, and often injures cattle. 2. *Abies Canadensis.* As an ornamental tree it is not much used, in the West, not being adapted to prairie soils. An evergreen found in the northern portions of the United States and the British Provinces. It is a good timber-tree, and often attains very great dimensions.

HEMORRHAGE. A flow of blood caused either from an accident, or from a full state of body. In the case of wounds, if severe, it may proceed from a torn artery that should be tied with a ligature. Strong compression should be used, by means of deeply stuffing the wounds, aided when possible with a tourniquet, or handkerchief twisted tightly by means of a stick, as in the case of a limb. The tourniquet to be applied above and below the wound.

HEMP. The cultivation of hemp for its fiber was formerly an important industry in the middle-Western States; Kentucky, Missouri, Illinois, and Indiana raising large quantities of it. In 1850, the production was 34,871 tons and in 1860, 104,480 tons. Since then the cultivation of hemp has declined, wire cordage, manilla, jute, coir and other fibers having in a great measure supplanted its use. Land which will yield fifty bushels of corn per acre will produce about a thousand pounds of undressed lint per acre. The crop, however, is a difficult one to manage and heavy to handle. Hence, notwithstanding the fact that per acre it represents a greater value than most crops, the expense attending its preparation has caused its diminished cultivation.

HEN. (See Poultry.)

HENBANE. *Hyoscyamus niger.* An annual herb, black henbane, found in waste places. Neither horses, cattle, swine, nor sheep, will eat this plant. The whole plant is deadly to poultry, whence its common name; it intoxicates hogs, but cows, horses, dogs and goats are able to bear a considerable amount before they are affected. The leaves are active only in the second year of the plant; if scattered about buildings, they are said to drive away mice and rats. Henbane owes its medicinal properties to an alkali, *hyoscyamia,* which can be obtained in a separate state. It is crystallizable. Besides this alkali, the plant yields, by destructive distillation, an empyreumatic oil, which is a powerful narcotic poison. Of late years the extract is much used in medicines.

HEN-HAWK. (See Buzzard.)

HEPATIC. Relating to the liver.

HEPATICÆ. A family of flowerless plants, resembling mosses, and growing in damp places.

HEPTANDRIA, HEPTANDROUS. Flowers with seven stamins.

HERBACEOUS. Of the succulent texture of an annual plant.

HERBAL. An account of plants; a collection of plants.

HERBARIUM. Literally a collection of dried plants. These may be arranged in books, properly named, or in cases, each according to its genera and family. Thus, in grasses, the cereal grains may be followed by meadow, and these by pasture grasses; or the several species of each genus, as triticum, in which wheat and couch grass both belong, may be arranged, following with the other genera of cereal grains and their representatives, and so through the whole category of plants to be saved, noting on cards attached peculiarities, etc.

HERBIVOROUS. Eating herbs; the ox, horse, etc,, are herbivorous.

HERD. 1. Applied to a number of cattle. 2. Applied to herding stock together in grazing.

HERD'S GRASS. (See Grasses.)

HEREFORD CATTLE. Hereford cattle, named from the county of Hereford, England, where they have long been the favorite cattle, have, within the last twenty years, gained an immense popularity in the United States, and now successfully contest the palm of victory with the best Short-horns at the leading fairs in the North. Massive, docile, fattening easily, and at an early age, with plenty of meat on the prime parts, possessed of hardy constitutions, they are, as with the Short-horns, possessed of all the good qualities that constitute a first-rate beef animal. They are especially regarded with favor in the great grazing grounds of the far West, for crossing upon the native stock there, and large numbers of the young bulls are yearly sent West from Illinois, Ohio, and Canada, for breeding purposes. One hundred years ago the Hereford, although an admirable animal for that day, were not bred to white faces; they were brownish or yellowish-red, some even being brindled. The illustration, page 181, will show the Hereford of eighty years ago, the cut being made from a picture of a Hereford of that day, in the possession of the editor. Gradually the white was made to extend along the top of the neck, also on the throat, dewlap, brisket and fore legs, belly and flanks. Then the feet were included, until we see the finished animal of to-day. The Herefords are undoubtedly allied to the Devons, and are among the most ancient of the distinct breeds of English cattle, The cows are not deep milkers, in fact they give but little milk, and are very much smaller than the bulls or oxen. In this latter characteristic they also resemble the Devons. The oxen are large, strong, honest, gentle, sagacious and long-lived. They work kindly in the yoke, and from their uniformity in color, are as easily matched as the Devons. The flesh is superior in quality, finely marbled with fat, heavy in the prime parts. The bulls are potent; when crossed upon the native red cows of the country, throwing the blood, both as to color, and general characteristics of the breed. Herefords are said to have been first brought to the United States by Henry Clay, in 1816 or 1817. They were, however, allowed to intermix with other cattle of the country, and were soon degenerated. An importation to Massachusetts, a few years later, left a favorable impress upon the stock of that State. In 1840, an importation of Herefords was made to New York and Vermont. In 1852, a very considerable importation was made into Ohio, where, with later importations, they have been most successfully bred, largely leaving their impress. In 1860 and 1861, importations were made into Canada, since that time successive importations and careful breeding have given the United States, and especially Maryland, Ohio, and Illinois, as fine herds of Herefords as are to be found in England. In England, the Herefords hold high rank, as they deservedly should, and in the great fairs there, as here, compete successfully with the best Short-horns. In the West, they are steadily gaining ground, and there are many who claim for them superiority over the Short-horns, as early maturing beef-makers. It is certain that they prove better on the butcher's block, and when we take into consideration the value of the full-blood and half-blood steers, as working oxen, and their wonderful constitutions, there is no reason to doubt that the time is not far distant when Herefords will be as common as Short-horns among the breeders and feeders of the flush pastures of the West. They are, however, too scarce and high priced in the United States for a full conception of their good qualities among the masses of our farmers. Turning to English authority, we find in the Agricultural Gazette of June, 1878, the following, in relation to the Herefords: This breed enjoyed the remarkable distinction of producing both the champion animals at Oxford, Grateful being declared to be the best bull, and Beatrice (a two-year-old heifer) being declared to be the best cow or heifer in the yard. Both, as may be supposed, were very good, the heifer pre-eminently so. She is a daughter of the famous bull Winter de Cote, and another instance of hereditary merit. The yearling heifers and calves indicate that this breed is, as beef-makers at an early age, quite up to the highest Short-horn standard. The Teeswater may milk better, and be more ready of adapting itself to local circumstances; but where the pasture is good, it is hard to beat the whitefaces for grazing. The editor of the Chamber of Agriculture Journal, writing at the same date, says of the Herefords: The Short-horn old bull class was both larger and better than usual. Last year it numbered but nine entries; this year the muster was thirteen, and they were headed by the crack bull of the period, Sir Arthur Ingram, Attractive Lad second. The yearling heifer class was a remarkably good one, as was also the heifer calf class. The old bull Hereford class produced an extraordinary animal in Grateful, who secured the reserve at the Hereford Show in 1876, but did not make his appearance at Bath or Liverpool last year. He has made wonderful development since appearing as a two-year-old, as is proved by the fact that Thoughtful, who was then placed above him, and has since taken firsts at Birmingham, Liverpool, and Bath, has now been put second to him; and that not only was he selected by the judges as the best Hereford bull on the ground, but in the contest for the championship succeeded in carrying it off, against such a Short-horn competitor as Sir Arthur Ingram. This is no slight honor to the Hereford breed, and of course any animal counted worthy of such a distinction, must be a first-class one. Grateful at four years old has capital loins and chines, with great thickness and depth of frame, and is very level all over; but his grand feature is the astounding mass of flesh with which his frame is covered. His girth is eight feet ten and one-half inches. In the cow class Lady Blanche, which took second prize at Bath, now came to the front position. She is marvelous at her fore flank, and displays a great mass of flesh on a well-shaped, grand frame, which, however, fell off slightly at the rump. The second prize cow, Little Beauty, was highly commended at Bath, and wonderfully retains her showyard merit at eleven years old. The two-year-old heifers, Leonora and Beatrice, were sure to win. Beatrice has recently reared a calf, which is slightly against her for showing; but Leonora is in full bloom with her beautiful head, symmetrical form, and all that loveliness which is so taking to the eye. After being selected as the best Hereford female on the ground, she carried off the champion prize against a remarkably shapely Short-horn heifer, and one of the best Devons, so that both cups were awarded to Herefords. On pages 478 and 479 will be found illustrations of an improved Hereford bull and cow.

HERMAPHRODITE. An animal or plant, in which there is a real or apparent concurrence of the generative organs of both sexes. It is most common in plants, and is also found among some of the lower invertebrate animals. In the higher orders it is unnatural.

HERMETICALLY SEALED. Perfectly closed on all sides. Entirely shut up. As properly prepared cans of fruits, etc., are hermetically sealed.

HERNIA. Under the names of Burst and Rupture, is designated a protrusion of the bowels or their coverings, through an opening of the abdomen, and also sometimes, especially in pigs, a protusion into the scrotum. In young animals it is easily cured by bandages. Return the protruding part, carefully bandage it, using a pad or truss to cover the tumor or swollen part, being careful in returning the gut that it is not strangulated or bursted. The bandage must be worn for months, or until the rent in the walls of the abdomen is entirely healed. If there is strangulation the animal must be chloroformed, and in this case a veterinary surgeon should be called.

HERPETOLOGY. The natural history of reptiles.

HESPERIDIUM. In botany, a many-celled, few-seeded, superior, indehiscent fruit, covered by a spongy, separable rind; the cells easily separable from each other, and containing a mass of pulp, in which the seeds are imbedded.

HESSIAN FLY. *Cecidomyia destructor.* The Hessian fly is so called because it was supposed to have been introduced into America with the forage brought by the Hessian soldiers, of the British army, during the Revolutionary war. It is a two-winged fly, very minute, about a tenth of an inch long, generally two-brooded in a season, and which in some seasons is very destructive to small grain and grass. The means of protection by brining the seed grain, is not reliable. The surest means for their extermination is burning over all places where they may hibernate, such as dead grass stubble, corn-stalks, etc. (See also Fly.)

HETEROCEPHALOUS. In composite flowers, when some heads contain male, and others female flowers.

HETEROGAMOUS. When the spikelets of the same grass contain dissimilar sexes, or when the flower heads of compositæ contain florets with different sexes.

HETEROGYNIA. A tribe of hymenopterous insects, as the bee and ant, in which one female is neuter and another fertile.

HETEROMERANS. A class of coleopterous insects, having the first and second pairs of legs with five joints in the tarsus, and the third pair with only four.

HETEROPTERANS. A tribe of hemipterous insects, in which the upper wing-cases terminate abruptly by a membrane.

HETEROTROPAL. When the embryo of a seed lies across it, but does not point toward its base or apex.

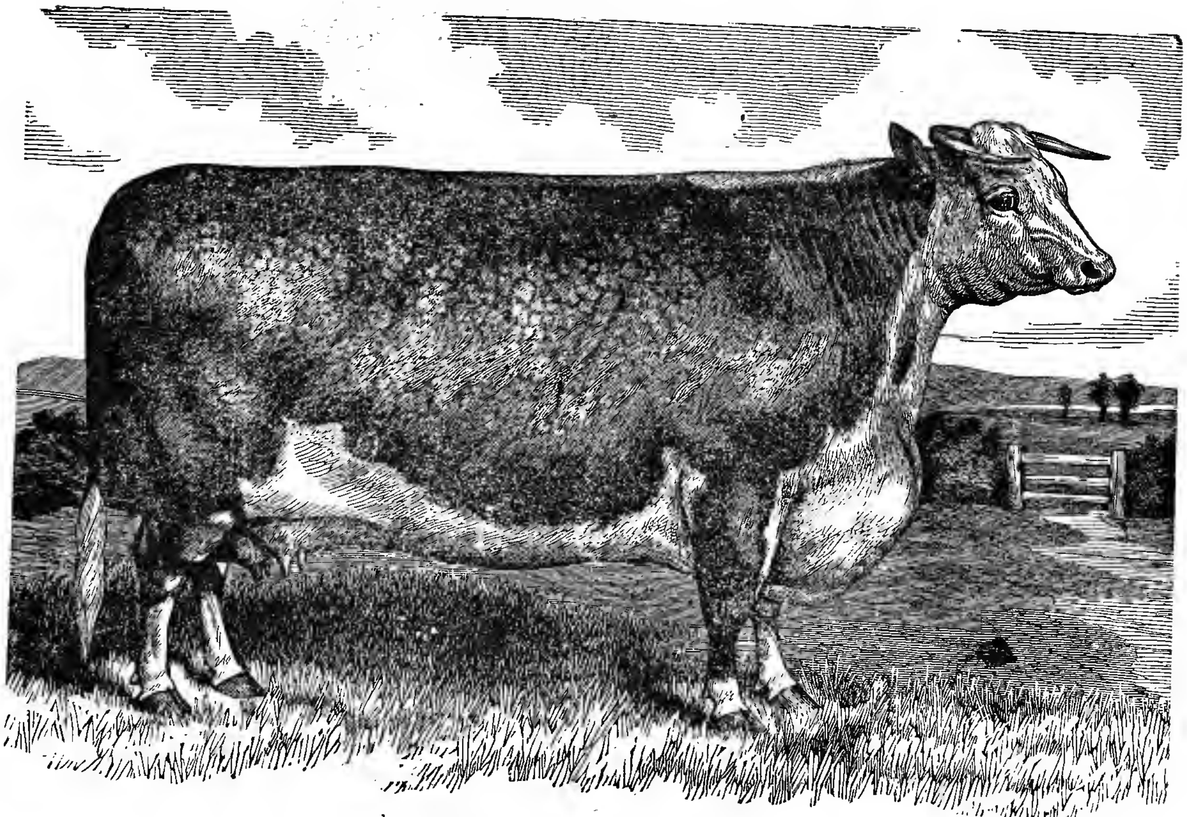
HEXAGYNIA. With six pistils.

HEXANDRIA. With six stamens.

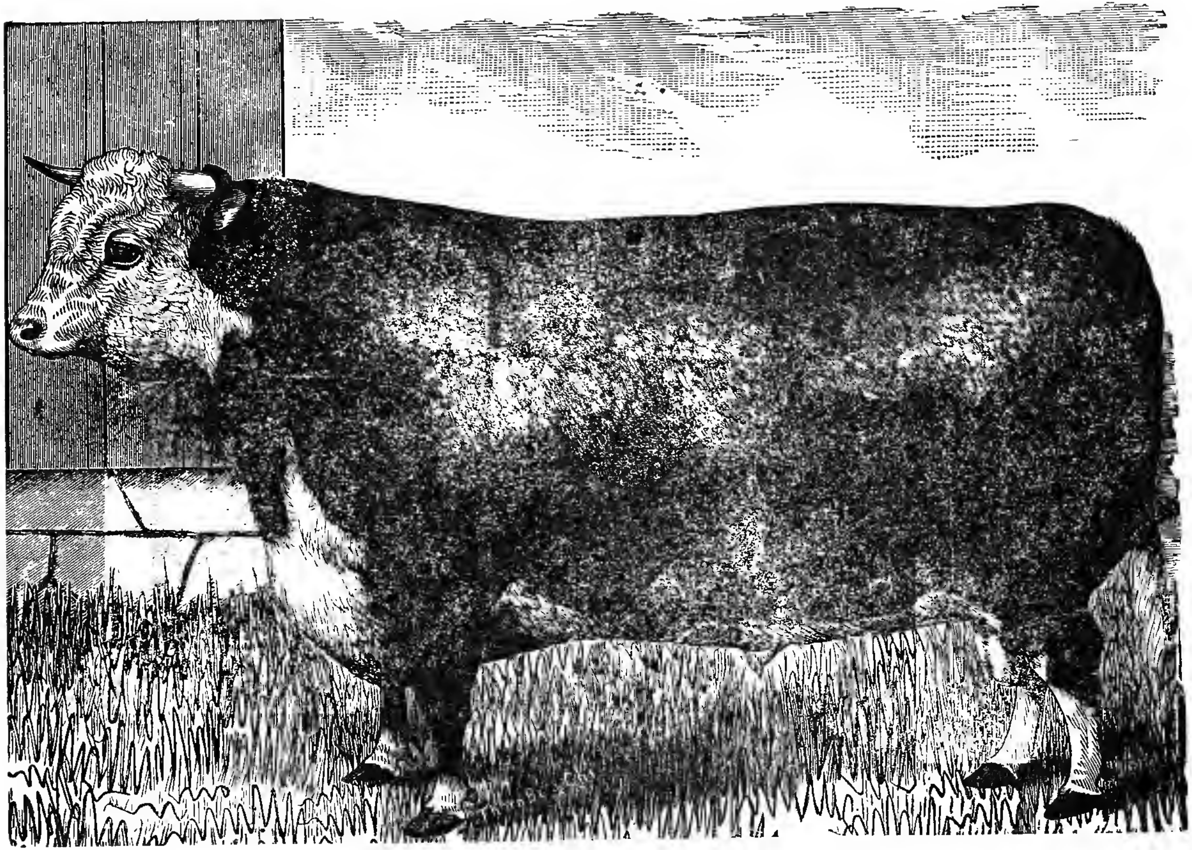
HEXAPODS. A tribe of wingless insects with six feet.

HIBISCUS. A genus of mucilaginous plants of the malvaceous family. (See Mallow.)

HICKORY. The hickory, *Carya*, of the order *Juglandaceæ*, is common in most parts of the United States, and is found exclusively on the American Continent. The species are the bitternut hickory, *Carya amara;* shell-bark hickory, *C. alba;* the thick shell bark hickory, *C. sulcata;* mockernut, *C. tomentosa;* pignut, *C. glabra;* and the pecan-nut, *C. olivæ-formis.* The different species grow in a variety of soils, never in wet ones, and resemble each other in the quality of the timber, and in the grain and quality of their wood. In the qualities of hardiness, weight, and strength, combined with elasticity, it is unsurpassed. The timber until thoroughly sea-

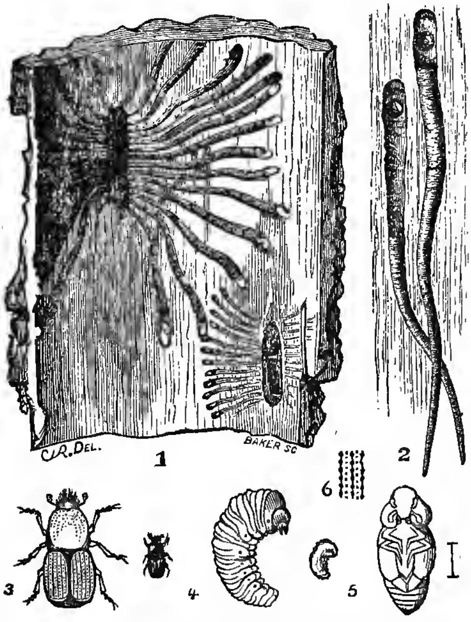


IMPROVED HEREFORD COW.



IMPROVED HEREFORD BULL.

soned, or if exposed to moisture is peculiarly liable to the attacks of insect borers, and is liable to decay in the presence of heat and moisture. For this reason, when wanted for timber, it is immediately peeled when cut, and seasoned in the shade as quickly as possible. The least valuable species for timber is the first mentioned, and the most valuable, all things considered, are the two next mentioned. The second growth of pignut hickory, however, is considered as being superior in strength and toughness, and is used for axletrees and handles for tools. The several species all ripen their nuts in the fall. The tree can not be transplanted except with great difficulty and loss. The nuts should be gathered and kept over winter by strewing in a slight trench, over them place thin inverted sods with a little earth over all, or keep them in boxes in moist sand in a cold cellar, until spring, when they may be planted two or three together where they are to stand, and all but one plant finally removed. Give clean culture until there is no longer danger of being smothered by weeds. If a hickory plantation is to be made, plant four by four feet, use the superfluous wood for poles, as they encroach on each other in growth, until finally the trees may stand thirty-two feet apart each way. At sixteen feet apart each way they may stand until nearly or quite one foot in diameter, since, the closer together, the taller and straighter will be the valuable part of the trunk of any tree. The hickory is subject to quite a number of insects, including leaf feeders, and especially borers. One of the worst of these is the Hickory Bark Borer, (*Scolytus four-spinosus*), a short oblong and nearly cylindrical beetle, called by Dr. Riley, *S. Caryæ.* It has short antennæ which terminate enlarged as in a club, the length is one-fifth of an inch; color black, with brown wing cases. The cut at 1, shows the burrows of the larvæ between the bark and the wood, growing wider as they diverge from the line where the eggs are deposited; 2, another view of the same, showing the hole made by the exit of the beetle; 3, beetle, both magnified and natural size; 4, larva, the same; 5, pupa magnified. The female beetle, says Dr. Cyrus Thomas, selecting the trunk or larger limb of a hickory tree, bores through the bark and forms a vertical chamber next to the wood from half an inch to an inch in length, on each side of which she deposits her eggs, varying in number from twenty to fifty. The larvæ when hatched feed on the inner bark, each one forming a track of its own, thus forming the radiating burrows so common on the under side of the bark of hickory trees. The larva is a soft, yellowish, footless grub, much like the larva of some of the curculios, and from which it can not easily be distinguished, except by its habits; it is very small, not exceeding the fifth of an inch in length when fully grown. The eggs are deposited during the months of August and September, and the beetle issues about the latter part of June or first of July. It attacks the bitternut, shell-bark and pignut, hickories, and probably the pecan. No practical remedy is known, nor is there much probability of any extensive experiments being made until forest timber becomes more valuable than it is now.



HICKORY BARK BORER. (See Hickory.)

HIDE-BOUND. Insufficient or improper food, especially if in connection with cold bad shelter, will occasion indigestion. There will be a rough staring coat, loss of condition, the skin will feel hard, and be stretched tight to the body, there will be shivering with or without shedding of the coat in patches; this is termed hide-bound. It might better be called a stingy man's monitor. The treatment is obvious. Easily digested food, a comfortable stable, blanketing, faithful grooming, and gentle alteratives occasionally to keep the bowels regular, should effect a cure.

HIDE, or HIDE OF LAND. An ancient measure of from 100 to 150 acres.

HILUM. The scar on a seed, where the funicle is attached, or where it is united with the carpel.

HIPPOBOSCA. A genus of viviparous, two-winged insects, which prey on horses and other animals; the forest flies are of this race.

HIPPURIC ACID. An acid existing in combination with soda, in the urine of horses, cows, and persons eating certain vegetables. It is separated by muriatic acid, and, when pure, is crystallized in silky needles.

HIRCIN. The fluid fat separable from suet, which gives it the peculiar odor resembling the smell of goats. By saponifying, hircic acid may be obtained.

HIRSUTE. Set with stiff hairs.

HIRUDINÆ. The tribe of leeches.

HIRUNDO. The genus of swallows.

HISPID. Set with minute spines, or stiff bristles.

HISTERIDÆ. A family of coleopterous insects with five joints on each tarsus, and belonging to the section of *Clavicornes.* They are peculiar from the quickness with which they feign death when in danger.

HOARFROST. Frost attended with the precipitation of much watery vapor. (See Dew.)

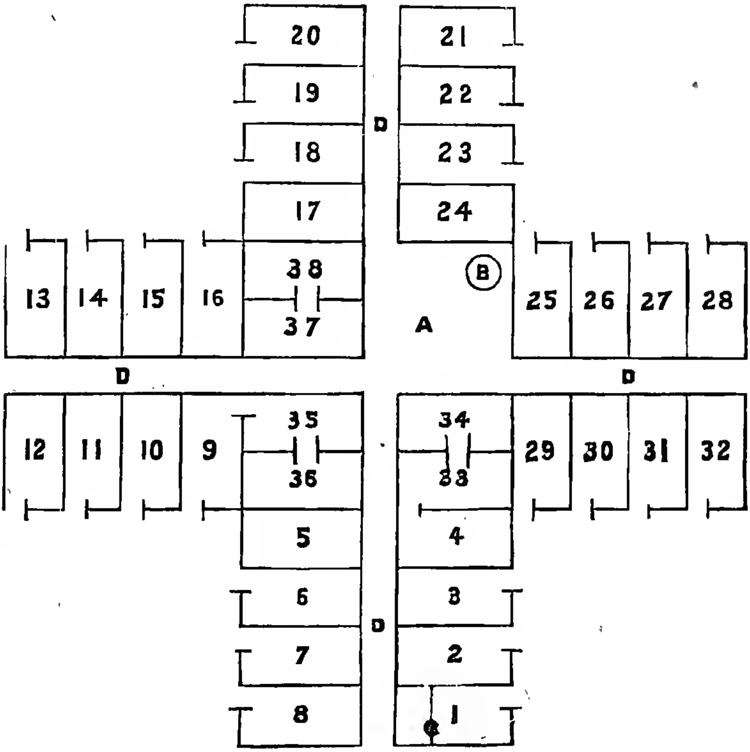
HOARHOUND. *Marrubium vulgare.* A plant formerly cultivated in every garden, the tea or decoction of the leaves being used for coughs, colds, etc. It is now a common weed in many places.

HOARY. In descriptive botany, covered with short hairs, so as to have a white or frosted appearance.

HOG. (See Swine.)

HOG CHOLERA. (See Cholera, Hog)

HOG HOUSE. In the breeding and rearing of swine, it is essential that they be kept from severe cold, and the attacks of insects. Nature has not provided them with a warm covering of hair. They are natives of warm climates where vegetable food may be found the year round. They are not fond either of great heat, since the sun affects their naked skin much in the same way it would that of man. Hence the care taken by the most intelligent breeders and feeders to provide them comfortable quarters, both summer and winter, one that may be partially darkened, in summer, and that will conserve heat in winter. Thus, by allowing them to take advantage of their natural instinct, in lying together in beds, they may be most economically managed. When but few are kept, simple pens, with enclosed places for sleeping may be provided. For fattening in autumn they may simply have a dry yard with a dark, close place in which to lie. When many are kept, the cheapest and best structure will be found a permanent one, containing an apartment for cooking food, pens for fattening and store hogs, pens for the boars and also the breeding sows. The best form is a central building, thirty feet or more square, and two stories high, the upper story to be used for grain and feed, the lower story as a cook room and for preparing the feed. From this central building wings are projected, on every side, twenty-four feet wide, and of sufficient length to accommodate the requisite number of hogs. These wings will allow pens to be made on each side of a passage way from which the hogs may be easily fed from a tank on low wheels. A yard should be attached to each pen, to which the hogs can have access at will. The outline ground-plan annexed, will give a good idea of a hog house or stable, where economy of space is connected with the best and most perfect system of feeding. The pens should be eight by ten feet, with door to yard outside and a suitable feeding trough next the passage way, These pens are kept bedded, and are to be regularly cleaned into a truck running in the passage way, and thence transferred to a wagon at the end doors, which also serve to take in feed, etc. This central building may contain six pens, and each wing as many as may be desired, although ten pens in each wing is as much as can usually be considered economical. A, shows central room; B, cooking apparatus; D, D, D, D, passage way.



HOG HOUSE.

HOGSHEAD. An old measure containing sixty-three wine gallons. A large barrel in which sugar, tobacco, and coarse produce are packed, containing from ten to fourteen cwt.

HOLCUS. The genus of soft grasses. (See Grasses.)

HOLERACEOUS. Culinary plants, potherbs.

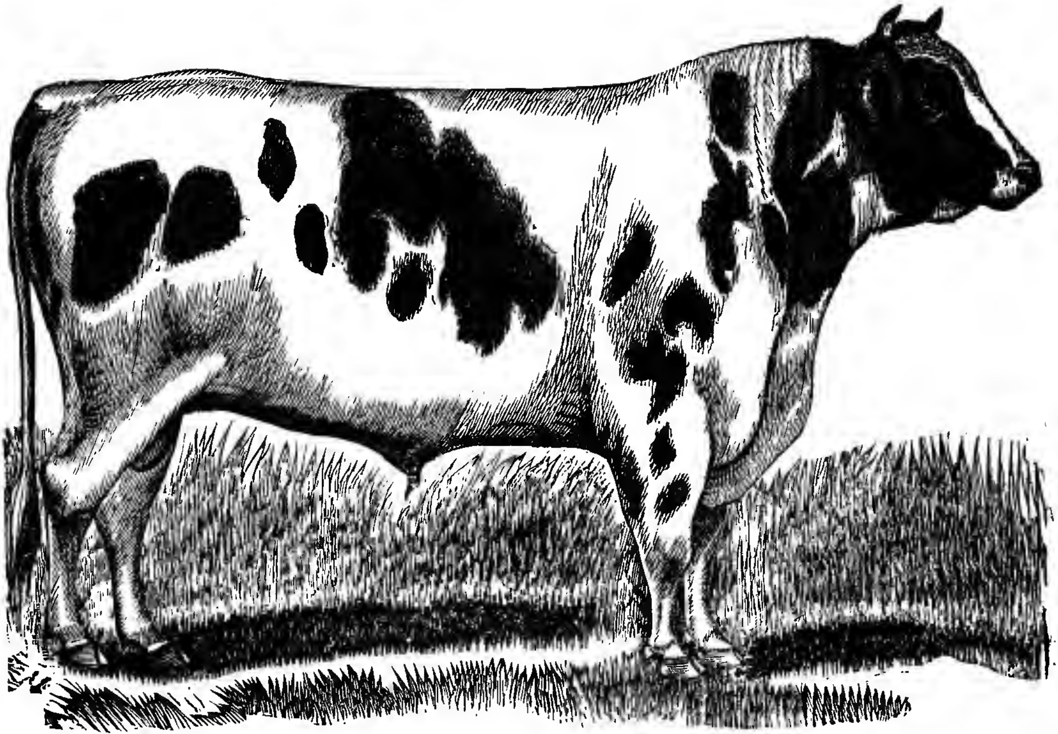
HOLLOW HORN. Anæmia in cattle, or horn ail, is more often produced by hollow belly, as it has not inaptly been termed, than by all other causes whatever. It is the twin with hidebound in horses, and is produced by the same causes, want of care and an unthrifty condition of the animal. It should be unnecessary to say that boring the horn, and pouring turpentine or other nostrums into the hole, splitting the tail, etc., is not only useless, but brutal. Give the animal a quart of linseed oil to clean out the bowels. If diarrhœa ensues check it with astringents; keep the animal warm, and give plenty of nourishing, easily digested food. As an assistant, give as a tonic, daily, two drachms sulphate of iron, one drachm powdered nux vomica, and one ounce of powdered gentian. Give in dry food, or as a drench in a quart of water or gruel, allowing it to trickle slowly down into the stomach.

HOLLY. *Ilex.* There are several species. The European Holly is not hardy much north of Washington. Our native holly (*I. opaca*) is hardy and beautiful.

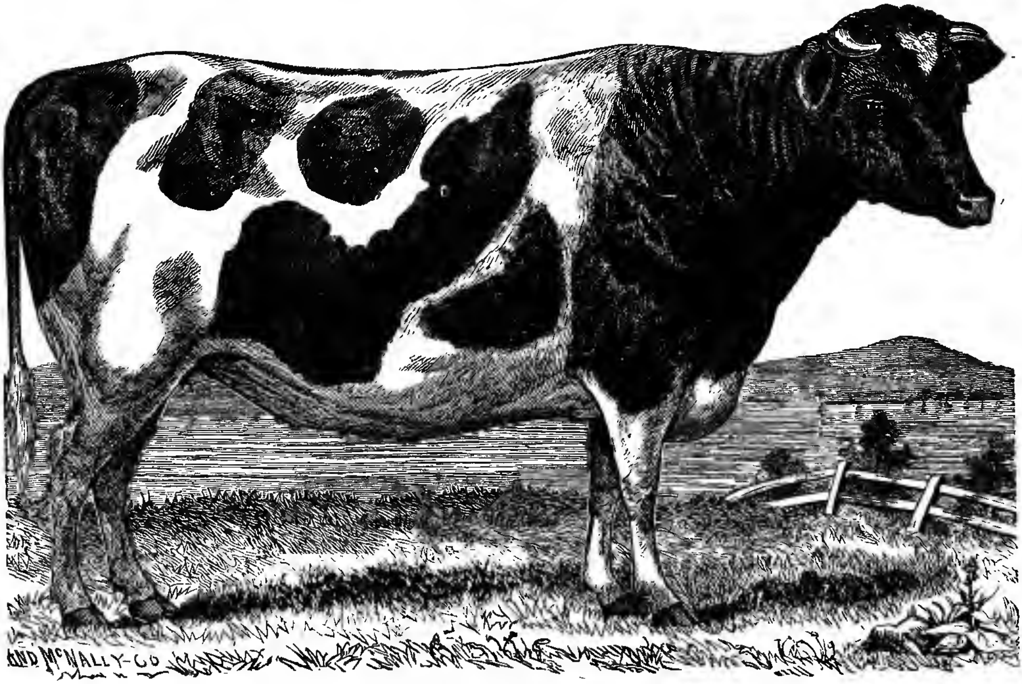
HOLLYHOCK. A biennial plant, *althea,* of which there are now many beautiful varieties, various in color, entirely double, and valuable for floral decoration in baskets, saucers, and other floral work, where very short stems may be utilized.

HOLLY OAK. *Quercus ilex.* A European species.

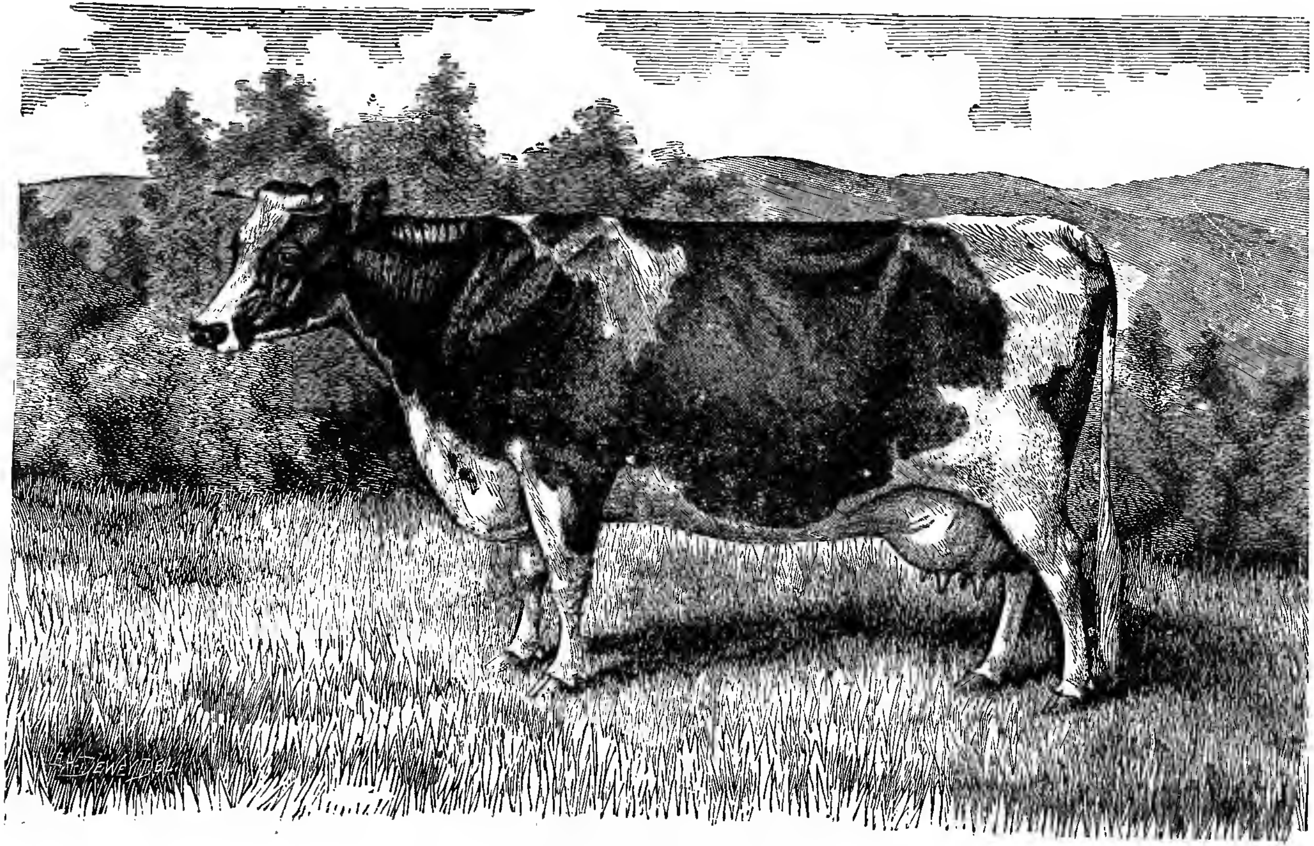
HOLSTEIN CATTLE. Within the last ten or fifteen years Dutch cattle, now generally called Holsteins (from the name of the country whence the principal importations have latterly been made,) have, in the West, grown into great importance. There, on the flush prairie pastures, their yield of milk, rich in curd, is most extraordinary. It is undoubtedly true that Dutch cattle were among the first cattle brought to America, for the reason that the Dutch were among the first settlers, and it is quite a supposable case that they would have been as likely to have brought their best breeds with them, to New York and New Jersey, as did the French their breeds to Canada, or the English to the New England and the Virginia Colonies. Hence, since the English first settled in Virginia in 1607, and the Dutch in New York in 1614, the presumption is evident that they brought the cattle of their native country with them. Indeed there is a record that cattle were imported by the Dutch in 1625, and that they were of the Dutch breed is more than probable, since these cattle were noted for milk and labor, the two prime necessities in any new settled country abounding with game. Where this wonderful race of Short-horned cattle first became broken up into the various sub-families, that are now generally recognized is not known, neither would it be interesting to follow. It, however, seems certain that within the last three centuries systematic attempts began to be made to breed them with a view to permanent improvement by fixing characteristics, that were specially desired to be perpetuated. It has resulted in fixing a breed of superior excellence as dairy cows, giving extraordinary messes of fairly rich milk. If, besides this, we take into consideration the fact that the Holsteins fatten kindly, when not giving milk, and to heavy weights it is not surprising that they should have become so largely sought after, especially in countries of flush pasturage, where dairying is one of the dominant agricultural industries. The hair of the Holsteins is short, soft, and fine. The skin is good in texture and of moderate thickness, fairly mellow to the touch, and their general form is that of great milking quality. The udder being extremely capacious, having great depth and breadth, with prominent milk veins running well forward, and with good sized teats standing well apart. The color should be pure white and black, either banded, pied, mottled, or else spotted over the body. The fashion, however, of to day, is against mottled and spotted, and in favor of distinctive markings, as shown on pages 484 and 485. The bull and heifer showing the spot peculiarities, and the cow the solid markings. Holsteins, or Dutch cattle, as a distinctive breed of milking cows, were introduced into the United States early in the present century, but the pure blood was soon lost. Sometime between 1820 and 1825, Mr. Herman Le Roy, a merchant of New York, imported some improved Dutch cattle and kept them on his farm near the city. Mr. L. F. Allen describes the descendents of these cattle in 1833, as being large, well spread, black and white, and remarkable for their uncommon yield of milk. This herd, however, was eventually scattered, and became mixed with the ordinary stock of the country. The first record of pure bred animals, the descendents of which have been kept so, seems to have been the importation of Mr. W. C. Chenery, of Boston. The first in 1852, being a single cow. In 1857, this gentleman made a further importation of a bull and two cows, followed, in 1859, by four other cows. Unfortunately some of the animals were infected with contagious pleuro-pneumonia, and with the exception of a single bull, the entire herd was destroyed. In 1861, Mr. Chenery made another importation of most superior animals, from celebrated milking herds, officially guaranteed by the authorities of North Holland, where they were bought, and the importation and their descendents were recognized as being high class milkers. There has been considerable controversy, of late years, as to the proper name to be applied to this breed of cattle, and it has been asserted that the Dutch cattle are descendents of cattle originally bred in Holstein. This is probably incorrect. In Holstein, (North Holland) however, more care seems to have been taken in breeding and selection. And from the fact that not only the original Chenery stock were brought from North Holland, but the principal importations of late years, the name Holstein has now generally come to be recognized, and undoubtedly for the reason that sagacious American buyers wisely acknowledged the greater uniformity of these cattle over those of the other strains of Dutch cattle. As giving facts in relation to these cattle, however, we append the conclusion of a letter, or rather elaborate statement, succeeding a previous letter, by Prof. Hengeveld, teacher at the Netherland Royal Veterinary Institute, Utrecht. This was written to Mr. Charles Mueller, United States Consul, at Amsterdam. Prof. Hengeveld takes exceptions to statements in the Holstein Herd Book, and after citing authorities to show that the Holsteins are descended from certain Dutch cattle, never, we believe, seriously questioned, concludes with much interesting testimony, valuable as giving very early history, showing among other matter much valuable information on various sub-families of cattle of the North of Europe. The extracts are as follows: According to the Allgemeine Deutsche Real Encyclopedia, the origin of Holstein-Schleswig lies buried in obscurity, and Holstein was probably visited by the Cimbri, while, a century after, the Roman Emperor Cæsar Tiberius arrived with his army and fleet before the mouth of the Elbe, without, however, setting foot on the Holstein shore. According to Tacitus, it may be stated that the Holstein Baltic coast was inhabited, as far as Mecklenburg and Schleswig, by seven petty German tribes, of whom the Angles and Warnes have preserved their names down to the present time, while the others have been melted down into that of the Saxons. In the fifth century, the Saxons and Angles united with the Jutes and Friesians, and migrated to England. (This is Low's colonization.) Subsequently the Holstein Saxons, who dwelt to the north of the Elbe, were called by the name of Normans, while the name of Holstein is not mentioned in history before eight hundred years after Christ. In 1128–'64, the Holstein province Uagrien was conquered and converted to Christianity, and partly peopled with strange colonists from Friesland, Holland, and Westphalia. The first Dutch colony in Germany, then called by the general name Thuringia, dates back as far as the year 528. From 801 to 864, St. Anskar, primate of Bremen, Hamburg, Holstein, etc., himself of Flemish birth, attracted many of his countrymen to those northern regions. Charlemagne also colonized Flemish peasants in the region adjacent to the shores of the Elbe. That stretch of teeming lowlands east of Bremen to the Baltic wore a vastly different face in those early days. Marshy and uncultivated, the coast edge of those parts stood exposed to the tender mercies of the sea to such a degree that even a slight breeze would suffice to cause immersion; while the inhabitants, through intestine wars, demoralized and habituated to strife and broil, evinced but little aptitude for the peaceful pursuits of husbandry. It was then that the attention of German princes was drawn to Holland, where similarly-situated regions had been brought to a high state of productiveness. The great tide of migration, however, did not set in till the twelfth and thirteenth centuries, from which period the origin of the fine grass-lands along the Elbe and the Weser must be reckoned. From these historical statements, it already appears that, with regard to its fitness as a grazing and cattle-breeding country, Holstein is of later date than Holland; which fact will appear the more prominent after some account has been given of the oldest inhabitants of Holland, and their pursuits. For this purpose I at once direct the attention of the reader to the coming of the Friesians and Batavians. The former were the oldest inhabitants of Holland, and were known as herdsmen, hunters, and fishermen. Their history in this country goes as far back as three hundred years before Christ. The Batavians came down the Rhine two hundred years after, or one hundred years before Christ; and although they were likewise herdsmen, they occupied themselves more particularly with hunting and fishing. The lands of the Friesians comprised the whole country to the north of the Rhine as far as the shores of the North Sea, to which West and East Friesland belonged, composing the present Dutch provinces of Groningen, Friesland, Drenthe, and North Holland, besides the provinces of Utrecht, Overyssel, and a part of Gulderland and South Holland. Of all these provinces, Groningen alone appertained to East Friesland. Tacitus says of the Friesians and Batavians: They owned cattle not exceeding in beauty but in number. He further states, as does also Julius Cæsar, that the Friesians and Batavians paid each other in cows, sheep, and goats, and gave likewise to their children, as dowry, oxen adapted to the yoke and plow cattle, and horses. When they were subdued by the Romans in the first centuries of our era, the conquerors derived much advantage from this wealth in cattle, and imposed upon the Friesians an annual tribute, consisting of cowhides and meat, while they chose their most valiant warriors from among the Batavians. The Friesians and Batavians applied themselves to the draining of their marshy lands and their islands; created meadows on the reclaimed soil, while the first protected against inundation by raising hills, breakers, and dikes, of which the traces are everywhere discernible along the coast throughout West Friesland and Groningen. Something is even known regarding the color of their cattle, namely, that they held those white in religious veneration. It is a very plausible theory that the Friesians, who, at as early a date as three hundred years before Christ, peopled the north of the present Netherlands, and wrought those alluvial plains of Scandinavian clay into soil fit for the requirement of their cattle, did, in after centuries, spread themselves in more northerly and easterly directions as far as the Elbe; as we already know they did, in the fifth century, unite with the Jutes and Anglo-Saxons in emigrating to England; in addition to which, we must observe that these were probably East Friesians and not West Friesians. The East Friesians from Oldenburg and the country near the Elbe, both south and north of that river, were compelled, through the inclemency of those regions, then in their original condition of low, alluvial swamps, inundated at every tide, to desert them. It was owing to these local circumstances that the Romans were prevented from endeavoring to land their army. It can be shown that the inhabitants of this territory were unable to make sure provision for their own wants, because of the robberies and piracies committed by the Normans, dwellers on the west coast of Denmark, people from Holstein and Schleswig, Jutes and Angles. These were by no means peaceful breeders of cattle, as were the Friesians and Batavians, whose land they constantly plundered and laid waste, burning and ravaging their possessions, massacring the inhabitants, making them pay tribute, penetrating far inland to the mouths of the Rhine and Yssel, and everywhere giving unbridled vent to their ferocity and love of plunder. This was between the eighth and eleventh centuries. Giving due weight to these statements, which, from the nature of the case, must necessarily be brief, it can not be doubted that the cultivation of cattle in the Netherlands existed a long time before such a thing could ever be thought of in Holstein. It is also quite as certain that the colonists from Friesland, Holland, and Westphalia carried with them their cattle to Holstein. Hence we see that, first, the



YEARLING HOLSTEIN BULL.



HOLSTEIN HEIFER.


E. H. DEWEY, DEL.

MODEL HOLSTEIN COW.

Dutch race of cattle date from an older descent than those of Holstein, while, probably, second, the Holstein cattle originated from the Friesian breed, and from that of the Dutch and Westphalian emigrants. After this colonization, we have our attention directed to another remarkable particular in the history of the Dutch cattle-cultivation. The Herdbook, unable to maintain the priority of the name Holstein from an earlier history of Holland and Holstein, might then, perhaps, seek its testimony in a later period, and the events to which your attention is now called. From the fourteenth on till the eighteenth century a large number of Danish oxen were annually turned for pasture into the grassy meadows of North Holland, formerly West Friesland, and sold at the weekly North Holland cattle-market. The oldest of these cattle-markets is that of the city of Hoorn. This market was already established in 1311, and, in 1389, the Danes and inhabitants of the Eyder were allowed by Albrecht, Duke of Bavaria, to hold a weekly market there. In 1605, the Danish cattle-market was removed from Hoorn and transferred to Enkhuyzen, where, in 1624, the number of 1,179 oxen were sold. There was also in Amsterdam a lean-cattle market, beginning in the spring, in the month of April, but held at irregular periods, depending upon wind and weather, when cattle were allowed to be conveyed from Denmark and Holstein hither to graze. These were mostly brought by vessel. These importations of Danish and Holstein cattle into North Holland, to which the Herdbook might refer, did not consist of heifers, but of lean oxen, which were pastured on the fertile meadows of the Polders, and afterward sold at the markets of Hoorn, Enkhuyzen, and Amsterdam as fat cattle. As to heifers, either then or now, having been imported from Holstein into Friesland and North Holland for breeding purposes, no such thing is known. To withhold nothing and to put nothing in a distorted light, we may add that in the middle of the eighteenth century several importations took place into Friesland of Danish cattle, consisting of young calves. This was at the time of the raging of the cattle-plague, which desolating disease carried off thousands of the finest cattle in Friesland and Holland. For the purpose of keeping the cattle-trade alive, and to fill the places of those destroyed by the plague, small Danish breeds and German cows of a diminutive size were substituted and crossed with the remaining and recovered natives. They were, says Scheltma, Danish-Holstein and small German cows, of which the greater part were smaller in size than the native race. We also find that one was reduced to the necessity, in 1769, of purchasing the needful cattle in the county of Bentheim, in the districts of Oldenburg and Munster, in Hanover, and other parts of Germany. In the work, Present State of Friesland, it is mentioned, that owing to the cattle-plague, the people were compelled to import from abroad all kinds of small cattle, chiefly Danish. But, what was remarkable, however small and ill-favored these animals might be, when compared with the handsome Friesian horned cattle, as a natural consequence, an improvement of food induced a favorable development of body, and, from the mixture of the two breeds, good and choice milch-kine were attained within two or three generations of the introduction of the foreign blood, no matter how much the race had in the beginning deteriorated through the process, and, eventually, the type of Danish and German cattle was quite lost. This is, however, more than one hundred years ago. A fair consideration of what has been thus far stated will leave no justification of the Herdbook's imputation upon the antiquity and purity of descent of our Friesian or Dutch cattle, or its assumption that they are of Holstein origin. No, the genealogy of Netherland cattle is pure and unadulterated, and it is at least two thousand years old. I come now to the present time, and the question whether it is tenable to give to one variety of cattle the name of an entire group, and to reckon as appertaining to it all its several varieties or breeds, as, for instance, the Dutch, Friesian, Oldenburg, Holstein, etc., and would it not be imperative in such a case to give it the purely historical name by which it is generally known? If it could be desirable to give a general name to the cattle of the just-mentioned districts, then that of Holstein cattle would not be appropriate, and for it should be substituted that of Friesian cattle, whence all the varieties originated. The chief characteristics of this Friesian breed—its eminent milk-giving and fattening qualities—we find in all the just-mentioned districts, and extending still further southward, with this difference, however, that wherever the land is more fertile, the climate milder, and the tending, feeding, and breeding of the cattle observed with more care, in that measure, and according as these requisites stand to each other in the closest proportion and harmony, they are more developed, attain larger size, and are of a finer texture. If the intention be to convey a correct understanding of the true qualities of the several varieties or breeds mentioned in their own dwelling-places, it is better that each breed should retain the name by which it is known, and that no collective name, though an historical one, should be given them. In order to be able to readily classify a group of cattle of great extent, possessing the same chief qualities in form, Strum proposed, so long as fifty years ago, to give to a group, subject to the same conditions of soil and climate, a name indicating those conditions, and thus originated the designations mountain cattle, highland cattle, and lowland cattle. He also heads each of these divisions by the breed best representing the distinctive feature of its class, as its type. It is under the denomination of lowland cattle that he places the different breeds of cattle of the coast-lands along the North Sea. Schmalz, Pabst, and many subsequent writers, adopt this classification—some with a few modifications; but all find in the physical characteristics of the country to which they are indigenous, the general denomination of the collective group. According to Schmalz's statement, cattle, adopting Strum's classification, may be distinguished in the following manner: A. Lowland race.—Primitive cow; Dutch Friesian cow. B. Mountain race.—Degenerate; quite the contrary of A, Swiss cow. C. Middle race.—Highland race; forms the transition from A to B; Frankish cow. Schmalz says: To the race A belong the Dutch, as representative, the Friesian, the Oldenburg, and chiefly all lowland races, bearing the peculiar characteristics which identify it with the place of its sojourn. This is a purely natural division, and there is not the least arrogance in asserting, what history points out, that the Dutch cattle constitute the type of the oldest, purest, and best breed. All other varieties are of less intrinsic value; they are coarser or smaller, possess less productive qualities, though of local excellence in their native places. If cattle of the genuine breed are bought, imported elsewhere, and there bred, why is it not called by its native name, and why must an appellation be given to it quite foreign and unknown to it. One hears in Europe of lowland cattle, but purchases of them for the purpose of improving other breeds have, for the last hundred years, been only made in the chief Netherland provinces, where the choicest cattle of the lowlands are found. Thus, thousands of Dutch and Friesian cattle are annually sent abroad under the name of Dutch cattle. Finally, I beg to add quotations from Dr. George May, director of the agricultural establishment at Weihenstephan, who visited Holland about ten years ago. The Dutch cattle constitute the type of the properly so-called lowland race, which extends throughout Netherlands, Flanders, Normandy, Oldenburg, and Denmark. Further on he says: The Oldenburg cattle descend from the Dutch race, and are likewise distinguished as East Friesian cattle, as still partially found in Hanoverian Friesland. In the adjacent parts of Bremen it is called Bremen cattle. The Holstein and Breitenburg cattle in the Wilster and Kempner marshes are equal to them, but with respect to their square build, the Breitenburg cattle are, in their properties, more like the finer Dutch cattle. To return to the Holstein: as milking cattle, they are wonderful; as cheese makers they are superior, as butter makers, they do not stand the test so well. In fact Holstein breeders always tell how much milk their cows will give; the Ayrshire men, how much milk, butter, and cheese, their cows will make; the Jersey owners, how much butter and cream to the quart of milk. To show that the Holstein is not a butter cow the following is deduced from a table published by the London *Agricultural Journal*, the results of tests made by Mr. Amersfoordt, of Badhoeve, most competent authority, in the Lake of Haarlem, Holland, who tested the milk of forty-six cows in June, and forty-nine cows in November, with Prof. Fesser's lactoscope, which is claimed to give a close approximation to the actual fat in milk. In the table made by Mr Amersfoordt, the yield of each cow on the 15th of June and the 24th of November, is given, with the percentage of fat. The average yield of forty-six cows in June, is 13.87 litres, or thirty-one pounds each, and the percentage of fat 5.217. Six of the largest milkers gave 20.2 litres, or forty-six pounds per day, with 5.2 per cent. of fat. On the 26th of November, forty-nine cows gave an average of 6.24 litres, of 13.92 lbs., with 6.32 per cent. of fat. The largest percentage of fat was 7.50. If the lactometer of Dr. Fesser is accurate, this shows that the Holsteins give milk as rich as our native cows, whose milk will yield five per cent. of butter, on flush grass in June, and seven per cent. in November. So, considering the noble milking powers of this breed, and their well known ability as cheese makers, their outcome in butter should be considered satisfactory, in consideration of their many valuable qualities, for milk, beef and labor.

HOMESTEAD. The regular arrangement of farm buildings, including the house.

HOMINY. Corn, usually of the smaller white flint kinds, bruised in a hominy mill or a mortar until the external covering is removed and sifted. Samp is corn broken coarsely in a mill.

HOMOGAMOUS. When all the florets contain both sexes.

HOMOGENEOUS. Bodies, all the parts of which are similar in composition.

HOMOLOGOUS. Having the same ratio or proportion.

HOMOPTERA. The name of an order of insects, including those in which the wing-covers are of a uniform semi-membranous consistency.

HOMOTROPAL. In botany, having the same direction as the rest of the plant, or that part to which it belongs.

HONEY. Honey has been regarded, from the remotest ages, as a product of the first importance to man. Wild honey is eagerly sought by savage and barbarous tribes, and bees have been kept from the earliest ages by civilized man. Honey is the saccharine fluid of flowers, gathered by bees and deposited by them in the cells of the waxen combs. Honey undergoes slight modifications in the honey-bag of the bees, but although somewhat changed chemically it retains the flavor, and to some extent the aroma of the flowers from which it was gathered. Under a powerful microscope the pollen of the plants, from which the honey was gathered, may be, it is said, detected, and thus often referred to the plant to which it belonged. Hence certain districts have become famous for its honey, as Mount Ida, in Crete, and others again are noted for the poisonous quality of the honey, as that of Trebizond. The substances recognized in honey, are grape sugar, manna, gum, mucilage, extractive matter, a little wax, pollen, acid, and the substances producing the odor of honey. Honey, as it drains from the comb, is quite fluid, but as generally pressed out it contains a sugar identical with grape sugar. This, however, except its disposition to candy, is not essentially different from the fluid portion. All honey is disposed to crystallize with age, and also to become yellow. The adulterations of honey are numerous. Starch, chalk, calcined gypsum, and even pipe clay have been used. Of late years, however, the adulteration of honey consists chiefly in adding glucose, a sugar now manufactured largely from corn, but only containing about thirty-four per cent. of saccharine, calling cane sugar 100. The adulteration by means of starch, chalk, etc., may be easily detected by heating the honey and letting it stand, when the impurities will settle to the bottom. Honey adulterated with glucose is more difficult of detection. Combs once used are even filled with the mixture. For this reason, pure white comb, capped by the bees, commands fully double the price, in the markets, of strained honey.

HONEY-DEW. An exudation of sweet gummy matter from the leaves of plants, especially the oak, beech, linden, and hop.

HONEYSUCKLE. (*Lonicera periclymenum.*) A hardy, attractive, and fragrant flowering shrub, that used to be found in every garden, thriving under adverse circumstances, even under the shade of trees. Of late years, it is not so generally cultivated, having given place to more pretentious, but not more handsome climbers. They should form a part of the collection about every farm house in the country. The following are the older and better known varieties: *Periclymenum Americanum*, the evergreen honeysuckle; *P. Germanicum*, the German honeysuckle; *P. Italicum*, the Italian variety; *P. Semper virens*, Virginian honeysuckle, Trumpet honeysuckle, a beautiful and constant bloomer; *P. racemosum*, the yellow flowering honeysuckle, with showy fruit, this is not strictly a climber; *P. verticellatum*, a tree-like honeysuckle, with inflected branches, and coral colored flowers; *P. vulgare*, generally known as English honeysuckle, or woodbine; *Lonicera Japonica* is the so-called Chinese honeysuckle, a most valuable plant for covering arbors, trellises, and pillars, with delicate and fragrant flowers; *L. brachypoda*, or Japan honeysuckle, is still more attractive; *L. ciliata*, Twinberry, grows abundantly in the mountains of Oregon and Alaska, and the berries are used as food by the Indians; *L. Tartarica*, the Tartarian honeysuckle is upright, or bush-like, and is well known.

HOODED. Cucullate. A descriptive term in botany, to express the partial covering of a flower, etc., by a petal or leaf, which is curved over it

HOOVE. (See Blown.)

HOPS. *Humulus.* The importance of this crop in all civilized countries may be inferred, from its constantly extended cultivation, scarcely affording a supply for the increasing demand. Its principal use being in the manufacture of beer. In 1840 the entire product of the United States was 1,238,502 pounds; in 1850, 3,497,029 pounds; in 1860, 11,010,012 pounds; increased in 1862 to 16,000,000 pounds. Since this time its cultivation extended wonderfully in the West until it was attacked by the aphis, when it began to decline. In 1866, the planting in Wisconsin raged like an epidemic throughout many parts of the State, and in Sauk county, one of the principal localities where it was planted, the crop exceeded 4,000,000 pounds, returning $2,500,000 in one year. In 1869, the crop of the United States aggregated 25,456,669 pounds. Since 1869 the acreage steadily increased until, in 1876, it approximated that of England, which was nearly 70,000 acres. The hop crop reached its maximum in 1877, being 110,000 bales. The season of 1878 was a disastrous one to the crop, and the acreage since that time has been decreased, but is now again increasing. In relation to the cost, one difficulty in hop-growing in the West, was that farmers rushed into it, without properly understanding the care and expense necessary to produce the crop. Hence, while some cultivators made money others signally failed. As showing something of the cost of the crop when ready for market, the following data will be interesting: A convention of hop-growers in New England, at a late session, appointed three different committees to estimate the average cost of producing hops. Committee No. 1, allowed $100 per acre for the average value of the land; cost of poles, fertilizers, and cartage, $44.10; labor in cultivation, $18; harvesting and curing, $64.36; insurance and marketing, $11.83; boxes, etc., $2.98; total, $141.27. A crop of 1,000 pounds would at such a rate average 14⅛ cents per pound. Committee No. 2, allowing $80 per acre as the value of the land, estimated the average cost of 1,000 pounds at 12¼ cents. Committee No 3, at $100 per acre, and with a yield of 800 pounds, made the average cost 12 1-5 cents per pound. The average cost of producing hops in Kent county, England, a famous hop district, is estimated by a local authority at £5 or $24.30 per hundred weight (not quite twenty-two cents per pound). As an illustration of the change in conditions of production the following statement of a hop-grower in Sauk county, Wis., during the flush times of 1867, is given: His yard embraced four acres, and the capital invested, including land, poles, drying-houses, stove, presses, etc., amounted to $2,000. During the second year of his investment, 1867, he estimated his expenses as follows: Interest on capital, ten per cent., $200; cultivation, setting poles, etc., $100; harvesting, curing, etc., $943; total expenses, $1,243. Receipts, for 11,520 pounds of hops at sixty cents per pound, $6,912; net receipts for hop roots, $3,040; total receipts, $9,952; net receipts, $8,709, or 435 per cent. The history of the hop shows it to have been cultivated from most ancient times. Mesne, an Arabian physician who died about 846, mentions the hop vine in his writings. When it was first introduced into England is not known, but about 1525, a doggerel appeared as follows:

> "Hops, heresy, pickerel and beer
> Were brought to England in one year."

In 1528, Parliament was petitioned to prohibit its use, as spoiling the taste of beer, nevertheless its cultivation continued to extend, until it has become a crop of prime importance among agricultural products. The soil and manure best adapted to the plant, may be determined by the general character of its growth. The soil should be deep, friable, containing humus, never wet but at the same time one that will withstand drought. Clay soils, if tenacious, should be thoroughly drained, since the hop roots penetrate deep and will not stand wet. Wet soils, hot suns, and drying winds in conjunction are fatal to the hop. Rather firm, deep, rich, well drained alluvial soils, protected from sweeping winds, are natural ones and the best, nevertheless, hops will not succeed in a close atmosphere, they require air, but do not like sweeping winds. The cultivation of the hop may be pretty well understood from the following, compiled from numerous authorities: The sexes of the hop plant are not united in the same plant, but some are male and others female. Since the sexual relation of the strawberry plants has been so thoroughly discussed in the United States, the importance of having some male plants in the hop grounds will be generally admitted. The male flower grows in a loose panicle, whilst the female flower is compact, like the cone of the pine tree. Hop seeds produce plants, but as they are like fruit seeds, producing varieties of quite different qualities, the hop plants should be multiplied by slips from a well known and approved variety. At the base of each scale or leaf of the female blossom of the hop there is a flower, in which is the germ of the seed. As this seed matures the scales grow larger, and are covered with resinous aromatic balls, called lupuline. These are the fine yellow powder of the hop, and contain the bitter principle that renders the hop so valuable in preserving and flavoring malt liquors. This bitter principle is stronger or more delicately flavored in some varieties of the hop than in others, and in proportion as the seed is fully developed. This female blossom is vitalized by the pollen of the male plant. Though the pollen, says an English writer, from its extreme lightness, can be wafted to a considerable distance, and some seeds in each cone may be so fertilized, yet it would be well to rear a number of the male plants among the others, or along the hedges of the hop gardens, to insure the fertilization of all the seeds. A bushel of hops collected from plants of the fourth year, raised from seed, weighed thirty-six pounds, there being male plants near; a second instance, where the plants were raised from cuttings, weighed thirty-five pounds; while a bushel, grown in a garden where the male plants were always eradicated, weighed only twenty-two pounds. Besides the greater quantity of hops thus obtained, the aroma is much greater, (the lupuline, on which the aroma depends, is considered by Blanché to be the unappropriated pollen dust which has alighted on the scales of the females,) and the strength of the bitter much greater On this point Mr. Rouse says: It is necessary that a small number of the male plants should be interspersed among the others, in order to give that energy and vitality to the seed which is essential to the perfection of the crop. If due care is taken in this particular, a seed will be found at the bottom of each petal of the blossom possessed of a most pungent aromatic flavor. Attention to this particular is, indeed, necessary to insure flavor and character to the product of the plant, giving it that fine aromatic bitter which is most desirable, and which it will not otherwise be possessed of, the petal or leaf of the blossom containing comparatively but little of the astringent quality of the hop. This consideration is one which I apprehend is too frequently overlooked by the inexperienced cultivator, who sometimes rejects the male plants as barren, to the great injury of the crop. He recommends one male plant to fifty female. In selecting the varieties of the hop to plant, two things are regarded in Great Britain—the flavor and the time of maturing. The strong growers are usually the largest bearers, but have not that delicacy of aroma that is found in smaller and less prolific varieties. In large plantations, where the picking season should be long, such varieties are selected as will give different times of maturity. In preparing to plant, it is best to bed in the spring the necessary sets, for by the fall they will have attained a year's growth, and whether they are set out in the fall, or in the following spring, it will be so much time gained. Then they are more certain to grow, will require a less number in the hill, and give much less trouble during the first year's growth after being planted. In Great Britain it is usual to plant in raised hills. But there the climate is moist; here the extreme droughts dry them too much. Hence, level cultivation, generally, has superseded hill cultivation, and the hop plant should not be an exception. In setting the plants, manure should not be put in the hill, especially new, unfermented barnyard manure, but a richer soil may be added, if the ground is not rich. The roots of the sets should be spread out carefully, fine mold put around them, the soil pressed firmly, and the earth heaped over them. Each hill should have two poles. In England, the number is determined by the kind of hop. The Farnham, Canterbury white bines and the Goldings are strong growers, and require large poles, from fourteen to twenty feet long. The Grape varieties are smaller, and need poles not exceeding ten to fourteen feet in length. As to the number of poles in Great Britain to the hill, the Cyclopædia of Agriculture says: When there are about 1,200 hills on an acre, and the poles all eighteen feet long and upwards, we should recommend two to each hill; with sixteen feet poles, every third hill to have three; with fourteen feet, alternately two and three poles; with twelve feet poles, three to each hill. But in this country, where ground is not so valuable as in England, a lesser number should be used, that more air and sunlight may be allowed, to lessen the evil of mold, and give greater vigor to the plant when held back by the aphis. The poles should be sharpened with a regular taper, and holes for them made by a heavy crowbar; and when two are in a hill they should be about a foot apart, the tops inclining somewhat apart, to give more room to each top, and prevent the branches from intertwining. The strongest poles should be selected for the outside, especially for that part of the plantation most exposed to heavy winds. In the spring the number of bines to each pole is selected. These should not be more than two; but it is best when the wire-worm is apprehended to reserve two more against their depredations, and until danger to them is past. The bine should be fastened to the poles, as their growth advances, with woolen yarn; and it is best when unraveled from a stocking, as it is more elastic. The grounds should be kept free of weeds or grass, and the hills almost level. The bines should be supported the first season on small poles, so that their better growth may be encouraged. In the spring following, the grounds should be well and deeply broken up, as soon as the soil is in a proper condition. Care should be taken not to do this when it is too wet. The furrow should be thrown from the hill, and the hill itself carefully weeded and pulverized, either with the cultivator or the hoe. The land should be leveled in the subsequent plowings with the cultivator. No better general directions can be given than to say that the hop should receive equal cultivation with the corn. A clean, mellow soil must be maintained. How to do this will require less or greater labor, according to the season, and the cultivation will be modified by it. Sometimes the cultivator is all that is needed after the first breaking up; at other times, when heavy, soaking rains have compacted the soil, it will be necessary to loosen with deeper working implements. Every operation demanded by the season should be performed in due time; and the more unfavorable the season is, the more cheerfully should be the labor given; for, in the cultivation of the hop, more than in all other crops, is the proverb true, that the hand of the diligent maketh rich. In such years, says Mr. Mainwaring, it will far better requite the labor bestowed, yielding a better price, by reason of their scarcity, than in fruitful years, when almost every ground produces hops. Industry and ingenuity are most encouraged and best rewarded at such times, but ignorance and sloth come off with loss. When the hops begin to change their color from green to brown, and emit a fragrant odor, they are ripe. Mr. Rouse says that the hop should be in full perfection before it is picked, and this is known when the seed has changed from a bright straw color to a pale brown, and emits a fragrant smell. Morton says: A hop may be considered ripe when it becomes hard and crisp to the touch; when the extreme petal projects in a prominent manner at the tip of the hop; when the color is changed from a light silvery green, to a deep primrose or yellow; and when, on opening the flower, the cuticle of the seeds is of a purple color, and the kernel, or seed itself, hard, like a nut. Even after the hop has attained a lightish brown color no real injury to its quality will have accrued, and, for many purposes, such hops are most esteemed in the market; but, after the hops generally attain a dark brown hue, a great loss, both in quality and weight, will be sustained. It is better to begin early than late in picking; but care must be observed lest the picking may commence too early. When in a proper stage of ripeness, four pounds of undried hops will make one of dry, and five pounds, scarcely ripe, are required to make one when dried. The hop, then, it will be seen, does not admit of a lengthened harvest, and hence, the hop-grower should timely secure all necessary aid; and that aid, when promised, under no circumstances should fail, as it so often does, in the harvesting of other crops. In England, the hops are commonly picked in large boxes, containing from twenty-four to forty bushels. These boxes are divided lengthwise by a thin partition, and then sub-divided into quarters. They are raised a little from the ground, and have handles at the ends to facilitate their removal from place to place, as may be desirable. One man and four girls are allowed to each box. Each girl deposits the hops she picks in her own division of the box. An industrious hand can pick twenty bushels in a day without difficulty. It is the business of the man to supply the boxes with poles, which he raises from the ground as needed, cutting the vines about a foot high; to see that the picking is properly done, to remove the empty poles, clear them of the vines, and stack them in a systematic manner. In picking, the hops should be kept free from stems and leaves, and all blasted or immature ones should be rejected. The boxes should be emptied at least once a day; at all events, no hops should be left in them over night. Three-fourths of the weight of the hops are water. So large an amount in so much bulk, and to which the air penetrates, demands that the drying should at once follow the picking, or heating and fermentation, when in bulk, will speedily follow. The hop house, or kiln, should be of a size proportionate to the quantity of hops to be cured, so that they may not accumulate on hand. To avoid this, it will generally be necessary to keep the kiln heated both day and night. It is commonly built of an oblong form, and of two stories, the lower part being occupied by the kiln and the press-room, and the upper part by the drying-floor over the kiln, and by a room of about an equal size for storing the dried hops, which will, of course, be over the press-room. Kilns are sometimes built of bricks or stone, of a circular form, with a round opening in the apex of the roof, surmounted by a movable cowl, or swinging ventilator, to enable the vapor of the drying hops to escape easily. If the building is of wood, the sides of the kiln should be lined with brick work, or thoroughly lathed and plastered. It is found to be most convenient and economical to heat it with stoves, from two to four of which will be necessary, according to the size of the kiln. The drying-floor should be ten feet from the ground, that there may be no danger of scorching the hops in drying. This floor is formed of slats about one and a half inch each in width, and the same distance from each other. They are covered with a strong, coarse cloth, of open texture, so as to admit of a free transmission of the heated air from the kiln below. The drying-room should be of comfortable height for a person to work in it, and the sides should be lathed and plastered, that there may be no irregularity of the heat in different portions of the room during high winds. A good ventilator should be provided in the roof, as described above. Openings should be left in the walls near the bottom of the kiln to admit fresh air from without, the draught to be regulated by means of flues, or sliding doors. The cloth for the drying-floor should be well stretched over the slats and firmly nailed. On this floor the hops are spread to the depth of six or eight inches. The proper thickness will depend somewhat on the condition of the hops; if they are very full of moisture, they should be laid on quite thin; but if gathered when fully ripe, and in fine weather, a depth of ten inches will be allowed. The great object, says Mr. Morton, with the hop-drier is to get rid of the condensed vapor from the green hops as quickly as possible, and the dry-houses should be so constructed as to effect this object perfectly. It must be borne in mind that hops should be dried by currents of heated air passing rapidly through them, and not by radiation of heat. This is a distinction of the utmost importance, since success is entirely dependent upon a strict adherence to the former principle. In order to accomplish this effect, the space above the hops must be kept hot, and all the lower parts of the kiln cold, whereby the greater density of the cold air will force the rarified air above, carrying with it the vapor from the hops, through the aperture or cowls upon the summit of the building. To aid this ascent of the heated air passing through the hops, a stream of heated air is sometimes thrown above the hops through a tube, thus adding greatly to the heat of the current passing through the hops, and giving it a greater ascending power. The hops being spread as evenly as possible, the fires are immediately kindled in the kiln, and the temperature regulated to one uniform degree of heat. This, however, may be quite high at first, as there will be at that time but little danger of scorching the hops if the floor is sufficiently high. If the hops are rusty, or discolored from any other cause, it is usual to burn a little sulphur under them, which will bring them to a uniform appearance. This is done as soon as the hops are well warmed through, and feel somewhat moist. Great prejudice formerly existed against the use of sulphur in drying hops; but no objection is now made to it by the brewers, and it is generally thought that the use of it improves the appearance of all hops, and that it also facilitates the drying. During the drying process the fires should be kept up, and there should be a free supply of fresh air below, sufficient to keep up a regular succession of heated air from the kiln, passing through the hops and out at the ventilator, carrying with it the vapor expelled from the drying hops. This will be found far preferable to a still, dead heat. As soon as the upper part of the hops appears to have felt the fire, the lower part may be considered as nearly dry, and will rattle a little. The heap may then be turned. Before this is done the heat should be suffered to abate a little, and increased again after the turning is finished. I am aware that many do not turn their hops while drying, nor suffer them to be disturbed at all until they are ready to be removed from the floor. Still, the better opinion, I think, is in favor of turning as tending to facilitate the drying and render it more perfect by the more effectually exposing every portion of the mass to the action of the heated current of air, than would be the case were they allowed to remain as at first deposited on the floor, containing many inequalities in density even when the utmost care is exercised in their distribution. If turned at the right time, and in a careful manner, there need be no injury done to the hops. When sufficiently dried they should be allowed to cool off a little, if time can be afforded, otherwise there will be great danger that they will break in moving, or a portion of them shell off and waste. Ten or twelve hours are required to dry a kiln of hops. Two kilns may be dried in twenty-four hours by keeping the heat up through the night. A twenty-foot kiln will thus dry 400 bushels in a day, as they come from the vines, making about 750 pounds of hops when dry. Let not the heat slacken, but rather increase it, till the hops are nearly dried, lest the moisture and sweat which the fire has raised fall back and discolor the hops. For these reasons chiefly it is that no cool air should be suffered to come into the kiln while the hops are drying. After the hops have lain about seven, eight, or nine hours, having left off sweating, and leap up when beaten with a stick, then turn them with a malt shovel or scoop made for that purpose; let them remain in this situation for two or three hours more, till every hop is equally dried. They must not be turned while they sweat, for that will scorch and cause them to lose their color; the fire may be diminished a little before they are turned, and renewed again afterwards; the heat should be kept as equal as possible. It may be of service to make use of a thermometer, by marking upon it the degree of heat proper for drying hops, as soon as that degree is ascertained by experiment. Mistakes are often exceedingly detrimental to the hops, and great attention is required by the drier, night and day, until finished. When they are thoroughly dry, which is known by the brittleness of the inner stalk, (if rubbed and it breaks short,) the fire should be put out, and the hops taken from the kiln into the cooling-room. Here they should be spread out not exceeding twelve inches in depth, and in a day or two will be ready to bale. Care should be taken to exclude a drying air from the cooling-room. The hops being dried, the next process is to bale them. This should not be done immediately after they are taken from the kiln, but they should be allowed to lie a few days in the store-room till they become a little softened, otherwise their extreme brittleness will cause them to be much broken in baling, and the sample be thereby greatly injured. The bales should be of a symmetrical and convenient form, and should contain about 200 pounds. They are formed in a box or bin prepared for the purpose, in the press-room, of such shape as will give the desired size and form. Across the bottom and sides of this box the baling cloth is first laid, and the hops are then let down into it from above and trodden down as they are dropped in until it is filled. Another cloth is then carried over the top, a follower applied, and the screws of the press turned down upon it until the whole is brought into a compact mass. The box is then taken apart, the cloth neatly secured around the bale, the screws are run up, the bale taken out, and the ends cased, when it may be considered finished, and the same process is repeated in forming another.

HOP CLOVER. (See Clover.)

HOP-HORN BEAM. (See Horn Beam.)

HORDEUM. The genus of barley grasses.

HORIZONTAL. Level. A plane parallel to the horizon.

HORN. Indurated skin, consisting for the most part, of modified albumen. It resembles hair in its chemical and agricultural properties, when shaved into thin strips, horn, whalebone, tortoise-shell, which are all similar, are readily softened by heat or hot water, and are then cut or molded into combs, handles for knives, rings, etc. Digested with water in an iron cylinder, under pressure, they are dissolved and yield glue. The horns of oxen and many other animals are only a covering over a bony process rising from the front bone of the head. This bone (horn pith) is remarkably porous, and full of blood-vessels, so that when it is cut or injured violent hemorrhage often follows, which is difficult to stop.

HORN BEAM. *Carpinus Americana.* Blue or Water Beech, or ironwood. Common along streams, growing from ten to twenty feet high. The trunk is ridged and the wood very white. The Hop-horn Beam, *Ostrya Virginica* is a larger tree, from twenty to forty feet high, bearing oval, oblong, hop-like fruit, rarer in the West than the Blue Beech.

HORNBLENDE. A dark green or black mineral, massive or crystallized in prisms, of glassy lustre, and readily scratched by a knife. It forms the basis of numerous minerals, and is found in several varieties, as augite, amphibole, pargasite, tremolite and actinolite.

HORNBUG. The beetles of the genus *Lucanus*, or stag beetles, especially *L. capreolus.* The grubs live in the trunks and roots of old trees.

HORNET. *Vespa maculata,* the American species. They build a globular nest of a substance like paper upon branches of trees, etc. It preys upon fruit, flies, etc. The European species is *V. carbro.*

HORSE. Zoologically considered the family to which the horse belongs consists of a single genus, *equus,* and is distinguished from all other quadrupeds by having only one apparent toe, and a single solid hoof on each foot, constituting the soliped, single-hoofed family of Cuvier's order, *pachydermata.* The different species of the genus *equus*, as the ass, zebra, quagga, etc., are all fertile together, and sometimes produce fertile hybrids. That between the male ass and mare, the mule is only second in importance to the horse for performing labor. From the ease with which the progeny of horses that have run wild for centuries, are broken in it is probable that horses were among the first animals domesticated by man. The time of the first domestication of the horse is, however, lost in the obscurity of the far past, but is first mentioned in history as being in use among the Egyptians some 650 years after the biblical account of the deluge. At the time of the exodus of the Israelites the horse certainly was used for draft. For at that time Pharaoh had numerous war chariots drawn by horses. It was from Egypt that Solomon received his great stud of horses, and Herodotus states that Xerxes obtained a portion of cavalry from Ethiopia, and that of his native Indian troops some were on horseback and others in chariots. The horse has so long ceased to exist in a purely wild state, that nothing has come down to us as to his original country, his habits, stature, or color. Of all the so-called wild horses, even those of Tartary are the progeny of animals escaped from a state of domestication. Few, if any, of our domestic animals have undergone such wide modification in size, color, and characteristics; or has become so widely spread over the earth as the horse. In Iceland and the Shetland Isles of the North, he is dwarfed to little more than the size of a large sheep, his limbs short but strong, his form uncouth from his shaggy hair, his mane and tail massive, coarse, and tangled; how different from the high bred racer of England and America, the mighty Clydesdale, or Norman, the long-backed Flemish, the active Barb, or the compact and beautiful Arab. A peculiarity of the horse, and one which should never be forgotten by the horse owner, is that he always breathes through his nostrils. Hence, in buying a horse, it should be especially noticed that his nostrils are capacious, open, and the covering thin and mobile. He is most sensitive to sound, his quick ear catching the slightest sound long before it is apparent to his master. The eye is also indicative of the character and temper of the horse. A bold, full, mild, but bright eye, shows the perfection of temper in a horse; if much of the white is shown, or if he has the habit of showing much of the white in looking behind, one may be pretty sure that he is a rogue and not to be trusted. In the wild state the horse is thought by some to have had no intermediate gait between the walk and gallop; this, however, is mere conjecture, and undoubtedly incorrect. The trot is to all appearances as much a natural gait as the walk, and generally used by colts of every breed, so in the domesticated horse the walk, trot, and gallop are the natural gaits, all others having been taught him, until through heredity, some of them, as the pace, may be called natural gaits. The age of the horse may only be told with any certainty by his teeth. The ancients understood this perfectly. Xenophon, in a work on horsemanship, alludes to the custom in selecting cavalry horses for the Grecian armies, to the rejection of such as have lost the dental mark. The examination of the teeth of horses to determine their age is also alluded to by various Roman writers, as Columella, Varro, and Virgilius. The teeth of the horse are forty: six nippers or incisors, two canines or tushes and twelve molars in each jaw. The mare lacks the canines. The dental system is: six incisors in the upper and six in the lower jaw; one canine in each side of the jaw of the male, female none; six molars in each side of the upper and lower jaw, thus making forty teeth in all. There are two sets, the temporary or milk teeth, succeeded by the permanent teeth. The canines are wanting in the colt's teeth, and in the permanent teeth of the mare, they seldom are apparent, though their rudimentary teeth may be found in the maxillary bone attached to the jaw. Three substances enter into the composition of the teeth, the enamel, the dental bone or ivory, and the cortical envelope surrounding the fang or root. The teeth, both incisors and grinders, are constantly being worn down at the crown by use, but this loss is supplied by gradual and continuous growth at the root. Thus upon this wearing away at the crown is based a perfected system by which the age of a horse may be pretty nearly told by an observing person. Mr. Youatt, than whom there is no better authority extant, in his treatise on the horse has very accurately described the teeth and their characteristics, which, with the illustrations will enable any one to judge correctly of the age of the horse. The statement is as follows: Seven or eight months before the foal is born, the germs or beginnings of the teeth are visible in the cavities of the jaws. At the time of birth, the first and second grinders have appeared, large, compared with the size of the jaw, seemingly filling it. In the course of seven or eight days the two center nippers are seen as here represented, Fig. 1. In the course of the first month the third grinder appears, above and below, and not long after, and generally before six weeks have expired, another incisor above and below will be seen on each side of the two first, which have now considerably grown, but not attained their perfect height. This cut will then represent the appearance of the mouth, Fig. 2. At two months, the center nippers will have reached their natural level, and between the second and third month the second pair will have overtaken them. They will then begin to wear a little, and the outer edge, which was at first somewhat raised and sharp, is brought to a level with the inner edge, and so the mouth continues until some time between the sixth and ninth month, when another nipper begins to appear on each side of the two first, making six above and below, and completing the colt's mouth; after which the only observable difference, until between the second and third year, is in the wear and tear of these teeth. These teeth are covered with a polished and exceedingly hard enamel; indeed it is so hard that it almost bids defiance to the action of a file. It spreads over that portion of the tooth which appears above the gum, and not only so, but as they are to be so much employed in nipping the grass, and in gathering up the animal's food, and in such employment even this hard substance must be gradually

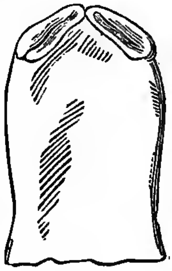


Fig. 1.

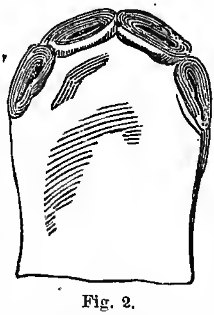


Fig. 2.

worn away, a portion of it, as it passes over the upper surface of the teeth, is bent inward, and sunk into the body of the teeth, and forms a little pit in them. The inside and bottom of this pit being blackened by the food, constitute the mark of the teeth, by the gradual disappearance of which, in consequence of the wearing down of the teeth, we are enabled for several years to judge of the age of the animal. The colt's nipping teeth are rounded in front, somewhat hollow toward the mouth, and present at first a cutting surface, with the outer edge rising in a slanting direction above the inner edge. This, however, soon begins to wear down, until both surfaces are level, and the mark, which was originally long and narrow, becomes shorter, and wider and fainter. At six months the four nippers are wearing to a level. The cut, Fig. 3, will convey some idea of the appearance of the teeth at one year. The four middle teeth are almost level, and the corner ones are becoming so. The mark in the two middle teeth is wide and faint, in the two next teeth it is longer, darker and narrower. In the corner teeth it is longest, darkest and narrowest. The back teeth or grinders will not guide us far in ascertaining the age of the animal, for we can not easily inspect them, but there are some interesting particulars connected with them. The foal is born with two grinders in each jaw, above and below, or they appear within two or three days after the birth. Before the expiration of the month they are succeeded by a third, more backward. The crowns of the grinders are entirely covered with enamel on the top and sides, but attrition soon wears it away from the top, and there remains a compound surface of alternate layers of crusted substance, enamel and ivory, which are employed in grinding down the hardest portion of the food. Nature has, therefore, made an additional provision for their strength and endurance. Fig. 4 represents a grinder sawed across. The five dark spots represent bony matter; the parts covered with lines of enamel, and the white spaces a strong bony cement uniting the other portions of the teeth. At the completion of the first year a fourth grinder usually comes up, and the yearling has then, or soon afterwards, six nippers and four grinders above and below in each jaw, which, with the alteration in the nippers we have just described, will enable us to calculate the age of the foal, subject to some variations arising from the period of weaning, and the nature of the food. At the age of one year and a half, the mark in the central nippers will be much shorter and fainter; that in the two other pairs will have undergone an evident change, and all the nippers will be flat. At two years this will be more manifest. The accompanying cut, Fig. 5, deserves attention, as giving an accurate representation of the nippers in the lower jaw of a two-year-old colt. About this period a fifth grinder will appear, and now likewise, will commence another process. The first teeth are adapted to the size and wants of the young animal. They are sufficiently large to occupy and fill the colt's jaws, but when these bones have expanded with the increasing growth of the animal, the teeth are separated too far from each other to be useful, and another and larger set is required. The second teeth then begin to push up from below, and the fangs of the first are absorbed, until the former approach the surface of the gum, when they drop out. Where the temporary teeth do not rise immediately under the milk teeth, but by their sides, the latter being pressed sideways are absorbed throughout their whole length. They grow narrow, are pushed out of place, and cause inconvenience to the gums, and sometimes to the cheek. They should be extracted. The teeth which first appeared are first renewed, and therefore the front or first grinders are changed at the age of two years. During the period between the falling out of the central milk teeth and the coming up of the permanent ones, the colt, having a broken mouth, may find some difficulty in grazing. If he should fall away considerably in condition, he should be fed with mashes and corn, or cut feed. The next cut, Fig. 6, will represent a three-year-old mouth. The central teeth are larger than the others, with two grooves in the outer convex surface, and the mark is long, narrow, deep and black. Not having yet attained their full growth, they are rather lower than the others. The mark in the two next nippers is nearly worn out, and it is wearing away in the corner nippers. The ages

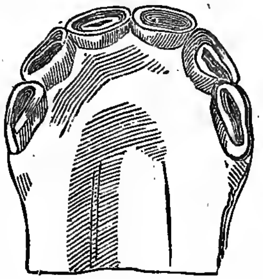


Fig. 3.

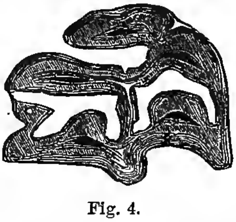


Fig. 4.

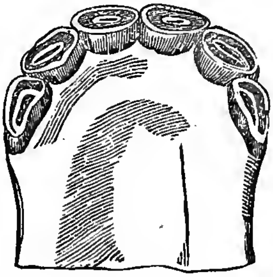


Fig. 5.

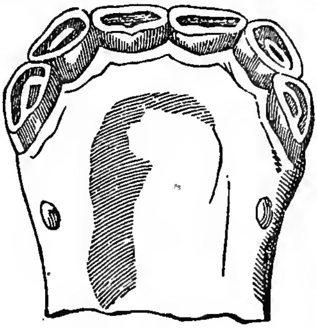


Fig. 6.

of all horses used to be reckoned from the first of May, but some are foaled even as early as January, and being actually four months over the two years, if they have been well nursed and fed, and are strong and large, they may, with the inexperienced, have an additional year put upon them. The central nippers are punched or drawn out, and the others appear three or four months earlier than they otherwise would. In the natural process they would only rise by long pressing upon the first teeth, and causing their absorption. But opposition from the first set being removed, it is easy to imagine that their progress will be more rapid. Three or four months will be gained in the appearance of these teeth, and these three or four months will enable the breeder to term him a late colt of the preceding year. To him, however, who is accustomed to horses, the general form of the animal, the little development of the forehead, the continuance of the mark on the next pair of nippers, its more evident existence in the corner ones, some enlargement or irregularity about the gums from the violence used in forcing out the teeth, the small growth of the first and fifth grinders, and the non-appearance of the sixth grinder, which, if it be not through the gum at three years old is swelling under it, and preparing to get through—any or all of these circumstances, carefully attended to, will be a sufficient security against deception. A horse at three years old ought to have the central permanent nippers growing, the other two pairs wasting, six grinders in each jaw, above and below, the first and fifth level, the others and the sixth protruding. The sharp edge of new incisors, although it could not well be expressed in the cut, will be very evident when compared with the old teeth. As the permanent nippers wear and continue to grow, a narrow portion of the cone-shaped tooth is exposed by the attrition, and they look as if they had been compressed, but it is not so. Not only will the mark be wearing out, but the crowns of the teeth will be sensibly smaller. At three years and a half, or between that and four, the next pair of nippers will be changed, and the mouth at that time can not be mistaken. The central nippers will have attained nearly their full growth. A vacuity will be left where the second stood, or they will begin to peep above the gum, and the corner ones will be diminished in breadth, worn down, and the mark becoming small and faint. At this period, likewise, the second pair of grinders will be shed. Previously to this may be the attempt of the dealer to give his three-year-old an additional year, but the fraud will be detected by an examination similar to that which has been already described. At four years, the central nippers will be fully developed; the sharp edge somewhat worn off, and the mark shorter, wider, fainter. The next pair will be up, but they will be small, with the mark deep and extending quite across them, as in Fig. 7. The corner nippers will be larger than the inside ones, yet smaller than they were, and flat, and the mark nearly effaced. The sixth grinders will have risen to a level with the others, and the tushes will begin to appear. Now, more than at any other time, will the dealer be anxious to put an additional year on the animal, for the difference between a four-year-old colt and a five-year-old horse, in strength, utility and value, is very great; but the want of wear in the other nippers, the small size of the corner ones, the little growth of the tush, the smallness of the second grinder, the low forehand, the legginess of the colt, and the thickness and little depth of the mouth, will, to the man of common experience among horses, at once detect the cheat. The tushes are four in number, two in each jaw, situated between the nippers and the grinders, much nearer to the former than to the latter, and nearer in the lower jaw than the upper, but this distance increases in both jaws with the age. In shape, the tush somewhat resembles a cone; it protrudes from the gum about an inch, and is sharp-pointed and curved. The appearance of this tush in the horse may vary from four years to four years and six months. It can only be accelerated a few weeks by cutting the gum over it. At four years and a half, or between that and five, the last important change takes place in the mouth of the horse. The corner nippers are shed, and the permanent ones begin to appear. The central nippers are considerably worn, and the next pair are commencing to show marks of usage. The tush has now protruded, and is generally a full half inch in height; externally, it has a rounded prominence, with a groove on either side; and it is evidently hollowed within. The reader scarcely needs to be told that after the rising of the corner nipper, the animal changes its name. The colt becomes a horse, the filly a mare. At five years, the horse's mouth is almost perfect—Fig. 8. The corner nippers are quite up, with the long deep mark irregular in the inside, and the other nippers bearing evident tokens of increased wearing. The tush is much grown; the grooves have almost or quite disspeared, and the outer surface is regularly con-

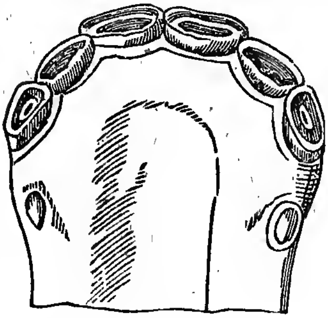


Fig. 7.

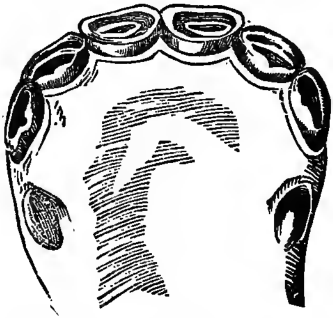


Fig. 8.

vex. It is still as concave within, and with the edge nearly as sharp, as it was six months before. The sixth molar is quite up, and the third molar is wanting. This last circumstance, if the general appearance of the animal, and particularly his forehand, and the wearing of the center nippers, and the growth and shapes of the tushes be likewise carefully attended to, will prevent deception, if a late four-year-old is attempted to be substituted for a five-year-old. The nippers may be brought up a few months before their time, and the tushes a few weeks, but the grinder is with difficulty displaced.

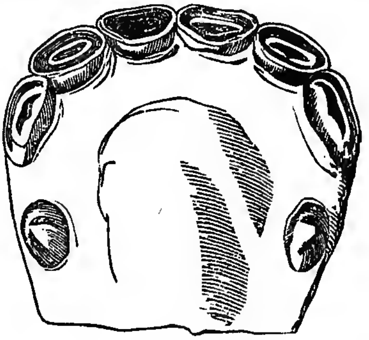


Fig. 9.

The three last grinders and the tushes are never shed. At six years—see Fig. 9—the mark on the central nippers is worn out. There will still be a difference of color in the center of the tooth. The cement filling up the hole, made by the dipping of the enamel, will present a browner hue than the other part of the tooth, and it will be evidently surrounded by an edge of enamel, and there will remain even a little depression in the center, and also a depression round the case of enamel; but the deep hole in the center of the teeth, with the blackened surface which it presents, and the elevated edge of enamel, will have disappeared.

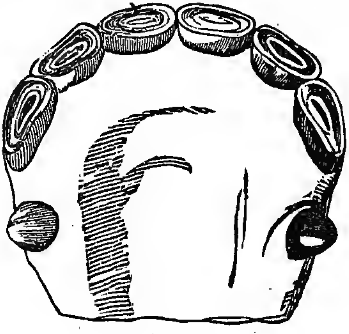


Fig. 10.

Persons not much accustomed to horses have been puzzled here. They expected to find a plain surface of uniform color, and knew not what conclusion to draw when there was both discoloration and irregularity. In the next incisors the mark is shorter, broader, and fainter, and in the corner teeth the edges of the enamel are more regular, and the surface is evidently worn. The tush has attained its full growth, being nearly or quite an inch long, convex outward, concave within, tending to a point, and the extremity somewhat curved. The third grinder is fairly up, and all the grinders are level. The horse may now be said to have a perfect mouth. All the teeth are produced, fully grown, and have hitherto sustained no material injury. During these important changes of the teeth, the animal has suffered less than could have been supposed possible. At seven years—see Fig. 10—the mark, in the way in which we have described it, is worn out in the four central nippers, and fast wearing away in the corner teeth; the tush also is beginning to be altered. It will be found that it is rounded at the point, rounded at the edges, still round without, and beginning to get round inside. At eight years old, the tush is rounder in every way; the mark is gone from all the bottom nippers, and it may almost be said to be out of the mouth. There is nothing remaining in the bottom nippers that can afterward clearly show the age of the horse, or to justify the most experienced examiner in giving a positive opinion. Dishonest dealers have been said to resort to a method of prolonging the mark in the lower nippers. It is called Bishoping, from the name of the scoundrel who invented it. The horse of eight or nine years old—for his mouth, see Fig. 11—is thrown, and with an engraver's tool a hole is dug in the now almost plain surface of the corner teeth, in shape resembling the mark yet left in those of a seven-year-old horse.

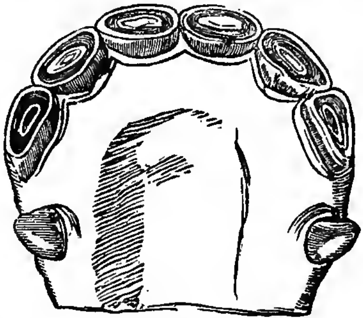
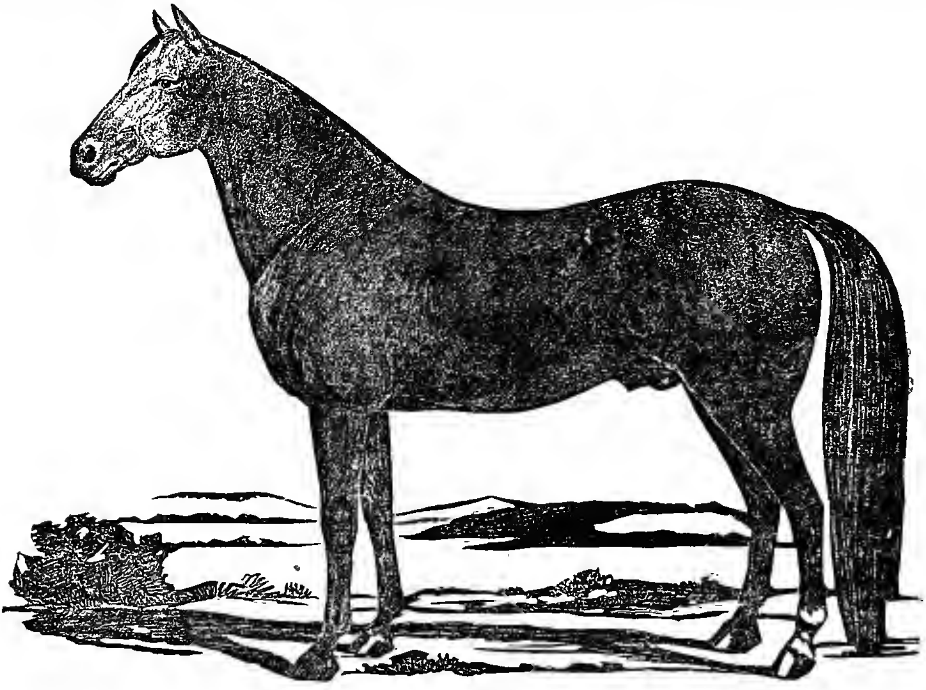
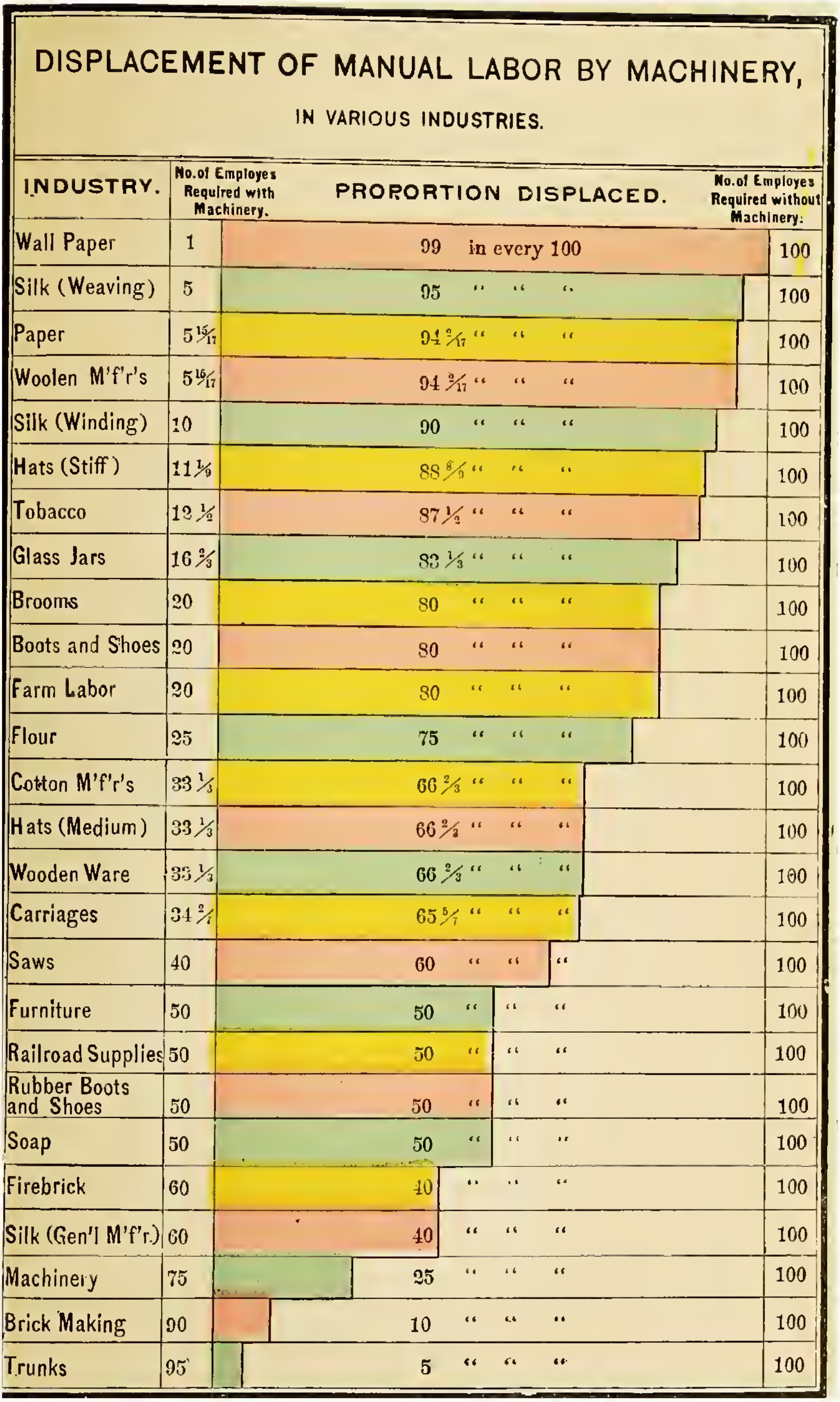


Fig. 11.

The hole is then burned with a heated iron, and a permanent black stain is left. The next pair of nippers are sometimes slightly touched. An ignorant man would be very easily deceived by this trick; but the irregular appearance of the cavity, the diffusion of the black stain around the tushes, the sharpened edges and concave inner surface of which can never be given again, the marks on the upper nippers, together with the general conformation of the horse, can never deceive the careful examiner. Horsemen, after the animal is eight years old, are accustomed to look to the nippers in the upper jaw, and some conclusion has been drawn from the appearances which they present. It can not be doubted that the mark remains in them for some years after it has been obliterated in the nippers of the lower jaw. There are various opinions as to the intervals between the disappearance of the marks from the different cutting teeth of the upper jaw. Some have averaged it at two years, some at one. Dr. Youatt was inclined to adopt the latter opinion, and then the age will be thus determined. At nine years the mark will be worn from the middle nippers, from the next pair at ten, and from all the upper nippers at eleven. During these periods the tush is likewise undergoing a manifest change. It is blunter, shorter and rounder. In what degree this takes place in the different periods, long and favorable opportunities can alone enable the horseman to decide. The alteration in the form of the tushes is frequently uncertain. It will sometimes be blunt at eight, and at others remain pointed at eighteen. After eleven, and until the horse is very old, the age may be guessed at with some degree of confidence, from the shape of the upper surface, or extremity of the nippers. At eight they are all oval, the length of the oval running across from tooth to tooth; but as the horse gets older, the teeth diminish in size—and this commencing in their width and not in their thickness. They become a little apart from each other, and their surfaces become round instead of oval. At nine, the center nippers are evidently so; at ten, the others begin to have the oval shortened. At eleven, the second pair of nippers are quite rounded, and at thirteen, the corner ones have also that appearance. At fourteen, the faces of the central nippers become somewhat triangular. At seventeen, they are all so. At nineteen, the angles begin to wear off, and the central teeth are again oval, but in a reversed direction; viz., from outward, inward, and at twenty-one they all wear this form. It would of course be folly to expect any thing like a certainty in an opinion of the exact age of an old horse, as drawn from the above indications. Stabled horses have the marks sooner worn out than those that are at grass, and crib-biters still sooner. At nine or ten, the bars of the mouth become less prominent, and their regular diminution will designate increasing age. At eleven or twelve, the lower nippers change their original upright direction, and project forward horizontally, and become of a yellow color. The general indications of old age, independent of the teeth, are the deepening of the hollows over the eyes; gray hairs, and particularly over the eyes, and about the muzzle; thinness and hanging down of the lips; sharpness of the withers, sinking of the back, lengthening of the quarters; and the disappearance of windgalls, spavins, and tumors of every kind. Horses, kindly and not prematurely used, sometimes live to between thirty-five and forty-five years of age; and Mr. Percival gives an account of a barge horse that died in his sixty-second year. As indicating what the best horses of the ancients were like, also as showing how near they approached to what would now-a-days be called a well muscled horse of all work, or a good roadster, the description of Xenophon in his instructions are as correct to-day as when written over 2,200 years ago, as follows: First, he says, we will write, how one may be the least deceived in the purchase of horses. It is evident, then, that of the unbroken colt one must judge by the bodily construction; since, if he has never been backed, he will afford no very clear evidences of his spirit. Of his body, then, we say that it is necessary first to examine the feet; for, as in a house it matters not how fine may be the superstructure, if there be not sufficient foundations, so in a war horse there is no utility, no, not if he have all other points perfect, but be badly footed. But in examining the feet, it is befitting first to look to the horny portion of the hoofs, for those horses which have the horn thick, are far superior in their feet.



MEXICAN HORSE OR BRONCHO.

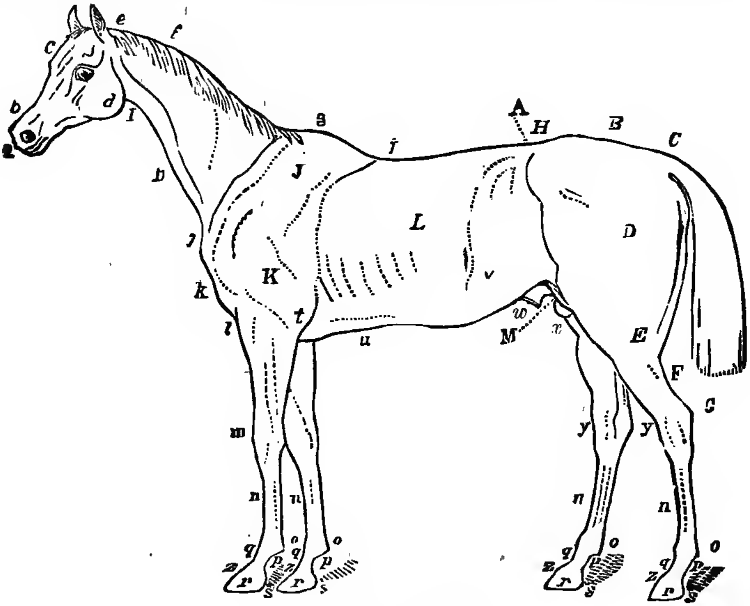


DISPLACEMENT OF MANUAL LABOR BY MACHINERY,

IN VARIOUS INDUSTRIES.

INDUSTRY.	No. of Employes Required with Machinery.	PROPORTION DISPLACED.	No. of Employes Required without Machinery.
Wall Paper	1	99 in every 100	100
Silk (Weaving)	5	95 “ “ “	100
Paper	5 15/17	94 2/17 “ “ “	100
Woolen M'f'r's	5 15/17	94 2/17 “ “ “	100
Silk (Winding)	10	90 “ “ “	100
Hats (Stiff)	11 1/9	88 8/9 “ “ “	100
Tobacco	12 ½	87 ½ “ “ “	100
Glass Jars	16 2/3	83 1/3 “ “ “	100
Brooms	20	80 “ “ “	100
Boots and Shoes	20	80 “ “ “	100
Farm Labor	20	80 “ “ “	100
Flour	25	75 “ “ “	100
Cotton M'f'r's	33 1/3	66 2/3 “ “ “	100
Hats (Medium)	33 1/3	66 2/3 “ “ “	100
Wooden Ware	33 1/3	66 2/3 “ “ “	100
Carriages	34 2/7	65 5/7 “ “ “	100
Saws	40	60 “ “ “	100
Furniture	50	50 “ “ “	100
Railroad Supplies	50	50 “ “ “	100
Rubber Boots and Shoes	50	50 “ “ “	100
Soap	50	50 “ “ “	100
Firebrick	60	40 “ “ “	100
Silk (Gen'l M'f'r.)	60	40 “ “ “	100
Machinery	75	25 “ “ “	100
Brick Making	90	10 “ “ “	100
Trunks	95	5 “ “ “	100

to those which have it thin. Nor will it be well if one fail, next, to observe whether the hoofs be upright, both before and behind, or low and flat to the ground; for high hoofs keep the frog at a distance from the earth, while the flat tread with equal pressure on the soft and hard parts of the foot, as is the case with bandy-legged men. And Simon justly observes, that well-footed horses can be known by the sound of their tramp, for the hollow hoof rings like a cymbal, when it strikes the solid earth. But having begun from below, let us ascend to the other parts of the body. It is needful, then, that the parts above the hoof and below the fetlocks (pasterns) be not too erect, like those of the goat; for legs of this kind, being stiff and inflexible, are apt to jar the rider, and are more liable to inflammation. The bones must not, however, be too low and springy, for in that case the fetlocks are liable to be abraded and wounded, if the horse be galloped over clods or stones. The bones of the shanks (cannon bones) should be thick, for these are the columns which support the body; but they should not have the veins and flesh thick, likewise. For, if they have, when the horse shall be galloped in difficult ground, they will necessarily be filled with blood, and will become varicose, so that the shanks will be thickened, and the skin be distended and relaxed from the bone; and, when this is the case, it often follows, that the back sinew gives way and renders the horse lame. But if the horse, when in action, bend his knees flexibly at a walk, you may judge that he will have his legs flexible when in full career; for all horses as they increase in years, increase in the flexibility of the knee. And flexible goers are esteemed highly, and with justice; for such horses are much less liable to blunder or to stumble than those which have rigid, unbending joints. But if the arms, below the shoulder blades, be thick and muscular, they appear stronger and handsomer, as is the case also with a man. The breast also should be broad, as well for beauty as for strength, and because it causes a handsomer action of the forelegs, which do not then interfere, but are carried wide apart. Again, the neck ought not to be set on, like that of a boar, horizontally from the chest; but, like that of a game-cock, should be upright toward the crest, and slack toward the flexure; and the head being long, should have a small and narrow jawbone, so that the neck shall be in front of the rider, and that the eye shall look down at what is before the feet. A horse thus made will not be likely to run violently away, even if he be very high-spirited, for horses do not attempt to run away by bringing in, but by thrusting out, their heads and necks. It is also very necessary to observe, whether the mouth be fine or hard on both sides, or on one or the other. For horses that have not both jaws equally sensitive, are likely to be hard-mouthed on one side or the other. And it is better that a horse should have prominent than hollow eyes, for such a one will see to a greater distance. And widely opened nostrils are far better for respiration than narrow, and they give the horse a fiercer aspect; for when one stallion is enraged against another, or if he become angry while being ridden, he expands his nostrils to their full width. And the loftier the crest, and the smaller the ears, the more horse-like and handsome is the head rendered; while lofty withers give the rider a surer seat, and produce a firmer adhesion between the body and shoulders. A double loin is also softer to sit upon and pleasanter to look upon, than if it be single; and a deep side, rounded toward the belly, renders the horse easier to sit, and stronger, and more easy to be kept in condition; and the shorter and broader the loin, the more easily will the horse raise his fore-quarters, and collect his hind-quarters under him, in going. These points, moreover, cause the belly to appear the smaller; which, if it be large, at once injures the appearance of the animal and renders him weaker, and less manageable. The quarters should be broad and fleshy, in order to correspond with the sides and chest, and, should they be entirely firm and solid, they would be lighter in the gallop, and the horse would be the speedier. But if he should have his buttocks separated under the tail by a broad line, he will bring his hind legs under him, with a wider space between them; and so doing he will have a prouder and stronger gait and action, and will, in all respects, be the better on them. A proof of which is to be had in men, who, when they desire to raise any thing from the ground, attempt it by straddling their legs, not by bringing them close together. Stallions should not have the testes large, and this ought not to be overlooked in foals. To conclude, in regard to the lower joints, of the shanks, namely, and the fetlocks and the hoofs, behind, I have the same remarks to make, and no others, than those which I have made above. Every horseman should thoroughly understand the points of a horse, and the terms by which these are designated. The above eloquent description of the horse has not been improved on since Xenophon's time. A study of the outline, and explanatory terms on page 498, will make the reader conversant with all that is valuable in the make-up of the horse, as seen in the exterior. A horse attains his greatest strength and vigor at nine or ten years of age, and continues in full vigor up to the age of fifteen, if he has been carefully used. Nine-tenths of the horses from being worked too young and from other abuse are often unserviceable before they attain the age of full vigor. At seven or eight years a horse is mature but has not arrived at his full vigor and strength. Their natural life is thirty years, but occasionally an individual lives to forty-five. If well cared for they will perform full work between the ages of eight and twenty years. An English writer, some twenty years ago, enumerates five horses in his stables whose ages respectfully were as follows: thirteen, twenty-one, twenty-six, twenty-nine and forty years. That they had been kept thus intact by good care, honest driving, and particular care in shoeing and attention to their feet. One of the best teams we ever owned were seventeen years old when bought, as lively as cats, and quite sound. They had been raised in the East by the farmer who drove them through from thence to Illinois before an emigrant wagon. The horse is the most perfect embodiment of strength and speed to be found in the animal kingdom. This is shown by his physiological development throughout. These have all been minutely described in many veterinary works, and in various encyclopædias. Hence a few extracts will here suffice. The skull is remarkable for the great width between the orbits, its flatness, the length of the face compared with the cranium, and the vertical depth of the lower jaw; the intermaxillaries project considerably beyond the nasal bones, the latter overhanging the cavity of the nostrils; the temporal arch is short, straight, and situated in the posterior third of the skull. The cervical vertebræ are of large size, and the posterior are oblong with short processes, so as to secure great freedom of motion in the neck; the dorsals are eighteen, with short transverse processes, and very long spines anteriorly to afford origins for the ligaments which support the head; the lumbar are six (but five in the ass), broad and firmly joined together, with remarkably developed processes, especially the transverse; the sacrum is a single bone, made up of five consolidated vertebræ, in a continuous line with the rest of the spine, and united to the last lumbar by the very large articulating oblique processes of the latter, securing a springiness in this region in leaping and galloping; the caudals vary from seventeen to twenty-one having the form of vertebræ only in the upper ones. The chest is capacious, compressed laterally in front, and prolonged in advance of the first rib so as to somewhat resemble the thorax of a bird; in the middle and posterior portions it is rounded, and extends far back toward the pelvis; the ribs are eighteen pairs, the anterior broad and massive (eight being true), and the posterior more slender. The clavicle is absent, and the coracoid process very rudimentary; shoulder blades, triangular, with a prominent spine, closely approximated to the chest, transmitting the weight of this half of the body perpendicularly to the ground; the arm bone is short and strong; the forearm consists almost entirely of the greatly developed radius, the ulna being a mere appendage consolidated in the adult animal to its posterior surface, though its olecranon process is of large size, affording a powerful purchase to the extensor muscles; there are no movements of pronation and supination, but only of hinge-like flexion and extension. The muscular system of the horse is very different from that of man, and has been described minutely in treatises on veterinary medicine. The panniculus carnosus, of which the platysma myoides of man is a rudiment, is greatly developed, and very movable, affording support and protection to various organs. The spinal muscles are of great extent and strength, especially in the neck and tail, which admit of much precision and grace of motion; the extensors of the forearm, the gluteus medius (the kicking muscle), and the muscles of the loins, extremities, and neck are generally very powerful; the muscles of the face, particularly those of the lips and nostrils, are largely developed, giving the well known variety of facial expression in this animal. The explanatory terms given below of points of the horse or the names of the several parts, will form an important study. They are generally recognized by horsemen everywhere, and should be correctly kept in mind by the reader, in that he may get a correct idea of the several parts.

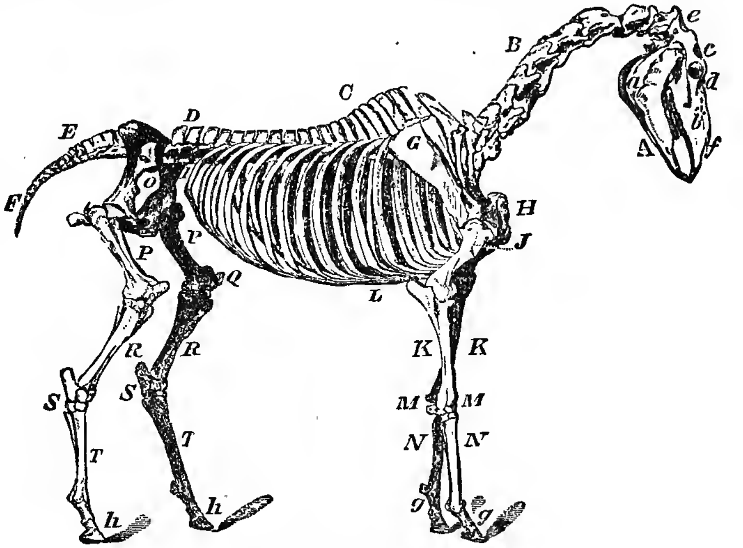


POINTS OF THE HORSE.

a, the muzzle.
b, the face.
c, the forehead.
d, the jowl.
e, the poll.
f, the crest.
g, the withers.
h, the windpipe or thrapple.
i, the back.
j, the point of the shoulder.
k, the breast or chest.
l, the fore-arm, called arm.
m, the knee.
n, the cannon bones.
o, the fetlocks.
p, the small pasterns.
q, the large pasterns.
r, the hoofs.
s, the heels.
t, the elbow.
u, the girth.
v, the flank.
w, the sheath.
x, the scrotum.
y, the hocks.
z, the coronets.
A, the hip.
B, the croup or rump.
C, the dock.
D, the quarter.
E, the thigh.
F, the hamstring.
G, the point of the hock.
H, the loins.
I, the gullet.
J, the shoulder.
K, the arm (proper).
L, the barrel (the ribs).
M, the stifle.

The skeleton of the horse is the frame work upon which is built the motive power of the animal. A study of the anatomy, and the names of the several parts, is important. The cut and explanations below will give these correctly and clearly:

A, the head.
a, the posterior maxillary, or under jaw.
b, the superior maxillary, or upper jaw; near the latter is a foramen, through which pass the nerves and blood-vessels, which chiefly supply the lower part of the face.
c, the orbit, or cavity containing the eye.
d, the nasal bones, or bones of the nose.
e, the suture dividing the parietal bones below from the occipital bones above.
f, the inferior maxillary bone, containing the upper incisor teeth.
B, the seven cervical vertebræ, or bones of the neck.
C, the eighteen dorsal vertebræ, or bones of the back.
D, the six lumbar vertebræ, or bones of the loin.
E, the five sacral vertebræ, or bones of the haunch.
F, the caudal vertebræ, or bones of the tail, generally about fifteen in number.
G, the scapula, or shoulder blade.
H, the sternum, or chest.
I, the costæ, or ribs, seven or eight, articulated with the sternum, and called the true ribs, and ten or eleven united together by cartilage, called the false ribs.
J, the humerus, or bone of the arm.



SKELETON OF THE HORSE.

K, the radius or bone of the forearm.
L, the ulna, or elbow. The point of the elbow is called the olecranon.
M, the carpus, or knee, consisting of seven bones.
N, the metacarpal bones. The large metacarpal, or cannon and shank in front, and the smaller metacarpal, or splent bones, behind.
g, the fore-pastern and foot, consisting of the *os suffraginis*, or the upper and larger pastern bone, with the sesamoid bones behind, articulating with the cannon and greater pastern; the *os coronæ*, or less pastern, the *os pedis*, or coffin bone, the *os naviculare*, or navicular or shuttle bone, not seen, and articulating with the smaller pastern and coffin bones.
h, the corresponding bones of the hind feet.
O, the haunch, consisting of three portions; the ilium, the ischium, and the pubis.
P, the femur, or thigh.
Q, the stifle joint, with the patella.
R, the tibia, or proper leg-bone; behind is a small bone called the fibula.
S, the tarsus, or hock, composed of six bones. The prominent part is the *os calcis*, or point of the hock.
T, the metatarsals of the hind leg.

The salivary glands, especially the parotid, are remarkably developed; the stomach of the horse is simple and capacious; the intestinal canal is long, but short in comparison with that of the ruminants; but the colon is of enormous capacity, as also is the cæcum, apparently occupying the greater portion of the abdominal cavity; the small intestine is about fifty-six feet long, with a circumference of from two and a half to six inches; the cæcum is two and a half feet long, and two feet in circumference at the widest part; the colon and rectum are twenty-one feet long, the former averaging two feet in circumference; the whole canal, therefore, is about eighty feet long. The liver weighs between four and five pounds, having no gall bladder, and the spleen twelve ounces; the urinary bladder is small in comparison with the size of the animal, its circumference when moderately distended being about one and a half feet; the mammary nipples are two, inguinal, and have at the base a hollow cavity which permits the accumulation of a considerable quantity of milk, which is often removed by man as an article of diet, especially for invalids. The hoof of the horse presents an admirable adaptation to secure solidity and elasticity in an instrument of progression; the whole exterior horny covering, to which the shoe is attached, composed of modified epidermic structure, is a hollow cone truncated above, into which the coffin bone is received; highest in front, it gradually diminishes backward, where it is suddenly turned inward, becoming mixed with the sole, supporting the under parts of the foot, and protecting the sole and the frog from too rough pressure against the ground; this internal wall, called the bars of the foot, by its sloping direction distributes the weight of the body toward the sides of the hoof, with whose numerous perpendicular horny laminæ interdigitate similar processes from the vascular surface of the coffin bone. In the triangular space in the center of the foot, is an elastic horny mass called the frog, its base connecting the posterior curves of the hoof, the sides united with the bar, and the point extending about to the center of the sole.

on the sides are deep channels, to allow of its expansion and render the foot elastic; its actual thickness in horn is not so great as farriers seem to think, from the freedom with which they use the paring knife; in a well formed foot, the base of the frog ought to occupy a sixth part of the circumference of the circle of the hoof; in the center of the frog is a horny conical cavity of considerable depth, which protects the partially cleft foot from further rupture, adds to the elasticity, secures a firmer hold on loose soils, and passing above into the substance of the sensitive frog, serves to unite firmly the two halves of the foot, which are completely divided in ruminants; this horny cone has been called the frogstay or bolt. The sensitive frog falls into the inverted arch of the horny frog, which are thus held mutually in place and preserved from external shock. The sole is an irregular plate of horn, closing up the lower opening of the foot, of an arched form, abutting everywhere against the sides of the wall, another contrivance for securing elasticity. The foot of the horse, therefore, though solid in front, is partially cleft behind, so that the terms *solidungula* and *solipoda* can not strictly be applied to it; indeed a solid, continuous, unyielding circle of horn would be very painful if not entirely useless as an instrument of active progression. Immediately under the hoof are extensive cartilages, attached to the last two bones, protecting the upper part of the structure and adding greatly to the elasticity of the foot, and permitting the movements of the coffin bone within the hoof. Under the hoof is also a very sensitive and vascular layer, from which the hoof originates, analogous to the soft core of hollow horns and the matrix of nails. The eyes of the horse are large, and the sight excellent, and capable of distinguishing objects by night; the ears are large and very movable, and the sense of hearing very acute, as in other timid and comparatively defenseless animals; the sense of smell is also acute, as is seen in their selection of food and in the recognition of their masters; the cutaneous sense is very fine, and the tactile powers of their movable lips exquisite. The movements of the horse are many; besides the walk, trot, gallop, and amble, pace, or rack, some horses gallop with the fore legs and trot with the hind, others move each leg separately in succession, and others execute many artificial movements, the result of education. The horse is quick to perceive and has an excellent memory, two qualities which render his training easy and extensive; he is capable of deep and lasting attachment. The neigh or voice of the horse is well known, the females exercising it less frequently than the males. In compact form, elegance of proportions, and grace of movement, combining speed and strength, it is surpassed by no animal; sculptors and painters have made the horse the subject of their chisels and pencils, and poets, sacred and secular, have sung its praises from time immemorial. Almost every part of the horse, after death, is useful to man; his skin is valuable for gloves, his hair for making cloth, his bones for buttons and for grinding into fertilizers, his flesh as food for dogs, his hoofs for making glue, and his intestines for the manufacture of delicate membranous tissues; so that the horse, said in ancient fable to have been created by Neptune as the animal most useful to man, can safely lay claim to being of the greatest value to the human race. It is an error to suppose there were wild horses found in America at the time of its discovery. The so-called wild horses of America are undoubtedly of Spanish origin escaped from the earlier Spanish adventurers, those of North America from the chargers abandoned by De Soto, and those of South America liberated at the abandonment of Buenos Ayres. This of course is mere conjecture, as to the exact source from whence they sprang. Certain it is, that no trace of horses were discovered by the first navigators visiting our shores. The same is true of the islands of the Pacific, and Australia, nevertheless, fossil remains of the equine race have been found, but they became extinct long before the historic period. Those which escaped from the Spaniards, however, soon multiplied, and congregated into vast droves in the tropical and semi-tropical regions north and south of the equator, where they live in a semi-wild, and even fully wild state.

HORSE-CHESTNUT. *Æsculus hippocastanum.* This tree is remarkable for the beauty of its figure, flowers, and early foliage. The wood is soft and of little value. The nuts contain much nutritious matter, which is combined with a disagreeable bitter. The Buckeye is of this genus, or, rather, of the sub-genus *Pavia.*

HORSE OF ALL WORK. The horse of all work may be designated as that class used principally on the farm, specially adapted to farm labor, but which being stout and true at a heavy pull, will at the same time be a tolerable saddle horse; and which on the road, besides drawing loads at a fair even pace, shall at the same time be capable of moving off at the rate of six or seven miles an hour, with the family carriage, if necessary. If to these qualities the animal, in addition should possess a handsome shape and carriage, he will indeed be a prize. It must be confessed that such animals are very rare, and when obtained are regarded by their owner with especial favor. In fact, such do not long remain on the farm; some acute horse buyer is sure to pick up all such animals for sale in cities, as light carriage-horses and horses of light draft. The horse of all work is, of course, always of mixed blood, that of the thoroughbred on the ordinary cold blooded mares of the country producing the largest number. As a rule, from want of care in breeding, they are apt to be weedy animals, really unfit for anything except light work. The horse of all work should be not less than fifteen hands high, and from that to sixteen hands, with a good head, a neck of medium length, well set on, rather oblique shoulders, withers rather high, a chest neither narrow nor broad, clean limbs, short bodied, round barreled, the rump and haunch long and muscular, and the tail set on rather high. A large, handsome roomy mare, stinted to a staunch, muscular thoroughbred makes, to our mind, the perfection of a horse of all work. A cross of a Cleveland Bay stallion,(which now-a-days possesses a strong dash of thorough blood,) crossed with a good sized, active, roomy, mare should produce animals that will do the work of the farm and road until six years old, and then be most salable horses for city work, either for the carriage, coupe, express work, or light draft, according to the style and make-up which they possess. In breeding for such horses, however, the farmer must have studied horses carefully, to become successful; far more so than the generality of farmers do. The greatest mistake made, is in breeding to thoroughbreds, weedy, or otherwise unfit for any profitable work. A stout, muscular thoroughbred, if he be handsome, and yet not speedy enough for the one or two-mile course, would be just the thing, and yet the most of the thoroughbreds used by farmers, who are horse breeders, are animals that can not possibly "stay" for more than a quarter, or at most half a mile. Two and three mile racers, stout and muscular, are wanted to assist in forming the horse of all work for our country districts, North and South. In the South, the horse of all work is especially a feeble and weedy animal. That section of the country lacks, essentially, the powerful work horses found almost everywhere in the North. Another class of horses suited to produce horses of all work, are stout, compact, large trotting stallions. Such are muscular, and of good bottom, and if, in addition, they are from fifteen and a half to sixteen hands, will leave their impress wherever used. If the farmer would select good sized, roomy mares to breed to such stallions, it would soon result in a class of farm horses, which, while doing the work of the farm, would, when ready for the market, command quick sale, and good prices.

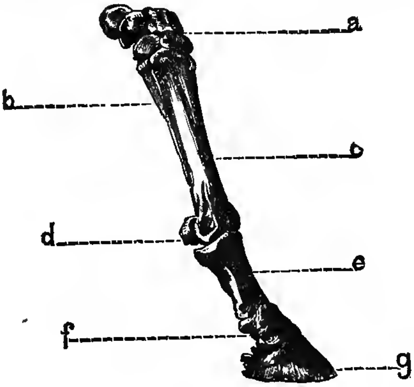


Fig. 1.

HORSE'S LIMBS AND FEET. It has been said that however superior the horse's body, lungs, and digestion, that he becomes an inefficient servant without these are accompanied with the most excellent limbs, and good feet; limbs are useless if the feet are unsound. It is, therefore, of the first importance that the greatest care be taken, not only of the limbs, but especially of the feet, since these latter are most liable to injury. In the article, Spavin, will be found cuts of the upper or larger bones of the limbs, showing diseased bony growths. It will only be necessary here to show the limbs below the hock and knee, including the hoof, to give an idea of the importance of the limbs. Fig. 1 shows the bones of the fore leg, side view; *a*, bones of carpus; *b*, splent or splint bone; *c*, cannon bone; *d*, sesamoid bone; *e*, pastern bone; *f*, coronet bone; *g*, coffin bone. At Fig. 2 is shown bones of hind leg, front view; *a*, *b*, *c*, *d*, *e*, bones of the tarsus; *f*, cannon bone; *g*, pastern bone; *h*, coronet bone; *i*, coffin bone. Fig. 3 shows a side view of hind leg; *a*, bones of the tarsus; *b*, splint bone; *c*, cannon bone; *d*, sesamoid bone; *e*, pastern bone; *f*, coronet bone; *g*, coffin bone. It will be seen that below the knee and hock, the names of the bones are similar. Thus, with the cut of skeleton previously given, the reader will not only get a perfect idea of the proper location of the bones but their correct names. Following is a comprehensive statement relating to the foot of the horse, as found in the correspondence of the United States Department of Agriculture, which we illustrate with references. Immediately below the carpus and tarsus is a single large metacarpal or metatarsal bone, called the cannon bone. Upon either side of this is a rudimentary bone, the splint bone. These two splint bones, expanded at their upper

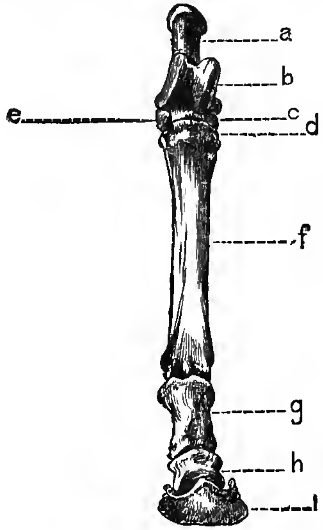


Fig. 2.

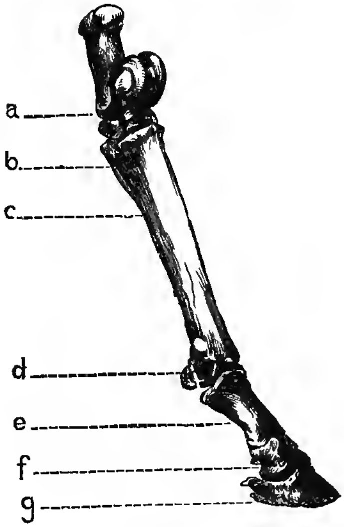


Fig. 3.

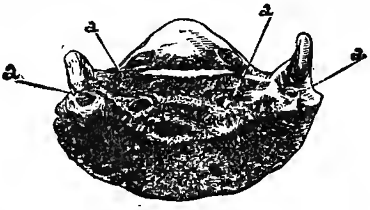


Fig. 4.

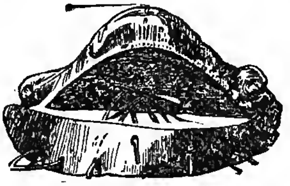


Fig. 5.

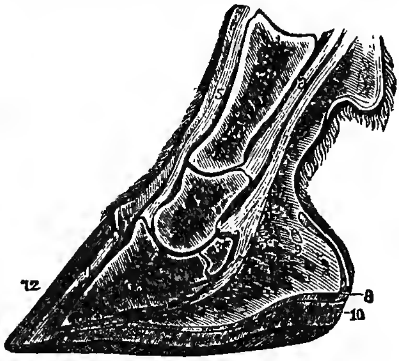


Fig. 6.

extremities, where they enter into the formation of the knee and hock joints, grow gradually smaller as they pass down by the side, and rather to the rear of the main bone, and terminate before reaching the fetlock joint. Below the cannon bone, taking an oblique direction anteriorly from it, is the pastern bone, long pastern, (*os suffraginis*). In length it is from one-third to one-half that of the cannon bone. Below this is the coronet bone, short pastern, lower pastern, (*os coronæ*) which is nearly square in form; its transverse diameter being however, greater than its vertical. The last bone terminating the extremity is the coffin bone, (*os pedis*). This bone has been described as having a body and wings. Its general outline is semilunar anteriorly, superiorly in its convex, and posteriorly and inferiorly it is concave. In texture it is light and spongy, perforated throughout by canals, (Figs. 4 and 5,) through which blood-vessels and nerves are abundantly distributed to the soft and sensitive tissues that cover it. The wings extend directly backward from the body, and support the lateral cartilages. Upon its superior aspect is a smooth and concave surface, placed obliquely to the body of the bone for articulation with the middle phalanx or coronet-bone. Applied to the joint between the coronet and coffin bones, posteriorly, and lying in the concavity of the coffin bone, is a small bone of peculiar shape—the navicular, (Fig. 6). This is a sesamoid bone, being contained in, or attached to, the tendon of the deep flexor. It is from two to two and one-half inches long, three-fourths of an inch in width at its widest part, and half an inch in thickness. Two surfaces of this bone, meeting in front at an acute angle, are covered with cartilage and synovial membrane. The posterior surface is rough for the attachment of the tendon of the deep flexor. Attached to the upper edge of the wings of the coffin-bone are the two lateral cartilages. They are irregular in form, elastic, and extend backward, giving form, substance, and elasticity to the heel upward as high as the pastern joint, and forward, so that only the width of the great extensor tendon of the foot separates them. In fact, the fibrous investment of the tendon is attached to these cartilages. The Cyclopædia of Anatomy and Physiology says, this widely distributed cartilage may be observed passing downward and surrounding on every side the rough and knotty extremities of the heels of the coffin bone, entering and filling up its sinuosities and taking strong attachment to these processes. It then extends horizontally inward, passing over the horny sole and bars, and, meeting the sides of the sensitive frog, intimately unites with it, forming one inseparable mass and filling together the whole interior area described by the sides of the coffin bone. The upright or lateral portion of the cartilage forms with the horizontal portion passing inward a right angle, thus making together a hollow space or receptacle at the back of the coffin bone that contains the spongy, elastic stuffing of the heels, together with the tendons, vessels, and nerves passing through the sole of the foot. The upper surface of the horizontal process of cartilage is full of scabrous elevations and depressions that defy dissection, among which is found a quantity of gelatino-ligamentous tissue. Beneath, or to the under surface of this horizontal layer, the sensitive sole and bar are adherent. As it approaches the frog or center of the foot, it loses its cartilaginous nature and becomes coriaceous, or rather ligamento-coriaceous, in texture, agreeing in this with the internal frog. The horizontal portion or process of the cartilage, known by veterinary writers as the stratiform process, is of greater thickness and substance than the other parts. It is also of coarser grain and more elastic nature. Both portions together communicate the general boundary of form to the lateral, posterior, and inferior parts of the foot. When the bars and the frog are thrust upward by pressure from without, they are acting against this same horizontal flooring formed by the cartilage and the frog, and are met by the depression of the bones of the foot forced down by pressure of the weight of the animal. The whole can then dilate exteriorly along with the posterior and more elastic parts of the hoof. Several important purposes are answered by this extensive distribution of elastic fibro-cartilage—1, the interposition of a layer of elastic tissue between the hard hoof and the hard bone prevents shock and jar to the body as the foot strikes the ground in walking or running; 2, the coffin bone not extending posteriorly much beyond the middle of the foot, except by its projecting wings, a large portion of the hinder part of the foot is made up of soft elastic cartilage instead of bone, breaking the force of the blow of the tread; 3, the distribution of elastic cartilage serves to equalize the pressure of the bones of the foot upon the broader surface of the hoof; and, lastly, this arrangement of an elastic cushion, increasing in thickness toward the posterior aspect of the foot, affords an elastic support to the movements of the coffin bone in the hoof, thereby aiding the elastic laminæ upon the superior convex surface in support of the bone. While the toe of the coffin bone is comparatively stationary, there is considerable motion of the heel upon the toe as a center, thereby contributing to the extent, freedom, and ease of movement of the foot. Molded upon the surface of the coffin bone, over its entire extent, is a thick, villous, highly vascular, and sensitive membrane having the general name of the sensitive foot, besides having several local names derived from the part of the hoof under which it lies, as sensitive laminæ, sensitive sole, and sensitive frog. This tissue is derived mainly from the skin. It may be said to be a process from the skin, covering the coffin bone, and altered in its structure to adapt it to its office as an excretory membrane. It exactly corresponds to that portion of the human skin which produces the nails. The proper skin of the leg, as it arrives at the foot, becomes thickened and altered in its structure, constituting the mass around the summit of the hoof, to which veterinary writers have given the name of coronary band. This is lodged in a groove seen around the upper edge of the horny wall, and from this the straight fibers of the wall are secreted. From the coronary band there is a prolongation of the skin downward over the coffin bone. This tissue is thrown into permanent folds or laminæ, the sensitive laminæ, between five and six hundred in number, arranged lengthwise of the foot. They secrete matter which enters into the formation of the horny wall, to the laminæ of which they are very closely united. According to Virchow, each lamina corresponds to a single papilla, as seen on the surface of the skin. Similar tissue, thickly studded with secreting papillæ, covers the inferior surface of the coffin bone, the fibro-elastic frog, and the widely distributed cartilages, already mentioned. This tissue is richly supplied with nerves and blood-vessels, the latter forming large plexuses which extend to and above the margin of the hoof. The elastic laminæ are found around the whole convex surface of the coffin bone, having a breadth of about one-tenth of an inch, and a length of about two inches in front, decreasing to an inch at the heels. These laminæ, much reduced in size and importance, are continued over the bars into the center of the foot. Each laminæ consists of a single plait or fold of two layers of membrane, which apply closely to, and are firmly attached to, two corresponding surfaces of the laminæ of the horny hoof. Either in the laminæ themselves, or in the fibrous membrane on which they rest, and which is the medium of their union with the bone, great elasticity resides, so that the coffin bone, with the weight it sustains, receives a large part of its support from the laminæ, acting as hundreds of elastic springs. It is this structure and arrangement that aid greatly in obviating shocks and preserving the integrity of the soft tissues at the bottom of the foot. By taking two strips of paper and folding them together in regular, even plaits, we have an illustration of the method of union between the soft and sensitive and the horny laminæ. If, in addition, one of the layers be considered elastic, the philosophy of the elastic suspension of the foot would be obvious. The tissue constituting the sensitive sole, averaging, perhaps, one-eighth of an inch, thinner over the frog and thicker over the heels, is even more fibrous, vascular, and sensitive than the laminæ. It is closely connected with the fibrous tissue of the sensitive laminæ in front and the covering of the heels and frog behind. From it the horny sole and frog are secreted. The sensitive tissues that invest the bones of the foot are covered and protected by a thick, dense, horny cap or box, the hoof. The physiological relation of the hoof to the parts which it covers is essentially the same as that of the human nail to the parts covered by it. Functionally, its relations are more extensive and complete, and whatever differences exist in structure, in form, or extent of development, come from modifications for special use. The hoof consists of three portions, which are so closely united as to seem but one; yet, by maceration, or by boiling, they can be separated. These are the wall or crust, the sole and the frog. The wall (Fig. 7, *e*, *e*, *e*) is all that part of the hoof that is visible below the hair when the foot is placed upon the ground. It is in the form of a cylinder, cut across obliquely at the top. It is deepest in front, from three to four inches, and grows gradually less in depth toward its posterior aspect. This wall, which is secreted mainly by the coronary band, and partly by the sensitive wall beneath, is in front about half an inch in thickness, becoming thinner on the back side as it extends around the foot. It has an edge bearing upon the ground of about half an inch around the outside of the bottom of the foot, (Fig. 7, *e*, *e*). Upon the inner side of the foot the wall is thinner than upon the outside. The explanation will show the relative parts: Ground surface of hoof, *a*, toe,; *a* 1, inner toe; *a* 2, outer toe; *b* 1, inner quarter; *b* 2, outer quarter; *c* 1, inner heel; *c* 2, outer heel; *d*, *d*, *d*, sole; *e*, *e*, wall of the hoof; *f*, *f*, the bars; *g*, *g*, the commissures; *h*, *k*, *l*, the frog; *h*, part under the navicular joint; *k*, boundary of the cleft; *i*, *i*, the bulbs of the heels. The wall is divided into toe, quarters, heels, and bars, superior or coronary border, inferior or solar border, and laminæ. Passing any special description of the borders, the laminæ deserve more particular attention. The lamina or *lamellæ*, are the very numerous, narrow, and thin plates which cover the entire interior aspect of the horny wall. They are in length from two inches in front to less than an inch at the heels. They

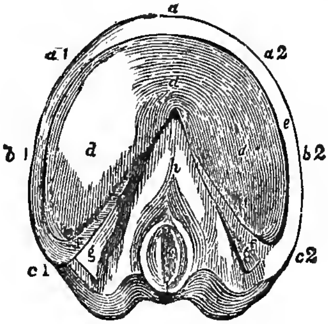


Fig. 7.

are also visible over the bars. They have a very constant width of about one-tenth of an inch, and extend from the lower to the upper border of the hoof, are essentially parallel to each other, and have a free edge and two free surfaces. Each lamella is received into, and is very closely united to two of the lamellæ of the sensitive wall. By this arrangement the surface by which the horny wall is attached to the sensitive hoof is very largely increased, (by exact calculation of Dr. Evans, increased by twelve times), and this attachment, while possessing great strength, has great elasticity, and admits of considerable motion between the horny sole and the coffin bone contained in it. The toe (Fig. 7, *a*) constitutes about two-thirds of the wall, and is sometimes subdivided, for minute description, into toe, inner toe, and outer toe, (Fig. 7, *a*, *a* 1, *a* 2). It is the deepest and thickest part of the wall, and stands at an angle, in the average of good feet, of about forty-five degrees. When the angle of inclination is much greater than this, the feet are designated as flat and weak. Flat and weak feet usually obtain in large and heavy animals, and it has been thought that as the foot is flattened, the anterior wall will be drawn down, by the weight, at length becoming fixed. The quarters (Fig. 7, *b* 1, *b* 2) are the portions on each side, midway between the toe and the heels, and are designated as the inside and outside quarters. The fibers composing them run obliquely upward and backward, parallel to those of the toe. The quarters slope downward and backward, and become thinner as they approach the heels. The heels (Fig. 7, *i*, *i*,) are the two protuberant portions of the wall by which it is terminated posteriorly. The wall here is shortest and thinnest, the fibers being only about an inch in length, and not exceeding the fourth of an inch in thickness. While, in its natural state, there is some degree of elasticity in the entire wall, there is much more in the portion that covers the heels. The bars (Fig. 7, *f*, *f*,) are reflections of the wall in toward the center of the foot, on its ground surface. They gradually approach each other, and come together a little in front of the center of the foot. The bars are usually regarded as parts of the sole, but maceration shows them to be separable from the sole, but inseparable from the wall. In the natural, healthy foot, that has never been shod, the bars appear as sharpened prominences, like braces, between the center of the foot and the heels. The best writers agree that they are well adapted to keep the heels open, and prevent contraction of the hoof. In the unshod foot, the bars have a bearing upon the ground, second only to that of the edge of the wall. The sole (Fig. 7, *d*, *d*, *d*,) fills the space between the wall and the bars. It is in the form of an irregular arched plate, the concavity being toward the ground. It is firmly attached, by its outer convex edge, to the inner surface of the solar border of the wall, while its inner straight edges are attached to the bars. It has been described as joining the frog, but throughout its whole extent the bars intervene between the sole and the frog. The center of the sole is the thinnest portion of it, and it also constitutes the summit of the arch. The lower circumference of the arch, which is also the thickest and strongest, everywhere abuts against the sides of the wall. The result of this mechanism is, that at every step, as the weight is thrown upon the foot, the coffin bone descends, elongating the elastic fibrous tissue connected with the sensitive laminæ, and, pressing upon the highly elastic tissue of the sensitive sole, which rests upon the arch of the horny sole, causes the latter to yield and descend. The wall being elastic, especially toward the heels, is readily pressed outward, so that the ground surface of the foot is larger while bearing the weight than it is when the pressure is removed. Whenever the weight is taken off, the wall springs back, and the sole recovers its arched form. By this means the step is rendered elastic, jarring is obviated, and injury to the sensitive sole and sensitive frog is prevented. The frog (Fig. 7, *h*, *k*, *l*,) is a wedge-like mass filling the angular space between the bars, and consists not of solid horn, as might at first seem, but of a series of elastic arches. It has been not inaptly compared to an elastic keystone received into an elastic arch, communicating in some cases, and admitting in all, the springing movements of which such an arch is capable. The base of the frog lies between and connects the posterior curved portions of the hoof, limiting to some extent their action. The sides are connected with the bars by their upper edges, leaving upon the ground surface two deep channels between the lower border of the bars and frog, which have been termed the commissures of the frog (Fig. 7, *g*). The horny material arching over these channels is called the arch of the commissures. In the center of the frog, as we look upon its ground surface, is a deep, narrow depression, the cleft of the frog, (Fig. 7, *k*,) which extends further into the soft tissues of the foot than the commissures. This cleft is arched over in a similar manner, and the cone-like mass, as viewed on its inner upper surface, has received the name of frog stay or bolt. Looking upon both the exterior and interior surface of the frog, we see that with the bars it forms three elastic foldings, which act as springs to keep the heels apart and the foot well spread. In the natural, unshod foot, the frog, though protected to some degree by the solar border of the wall and by the sharp prominences of the bars, must still receive pressure at each step. The order of force in which the different parts of the foot press the ground in walking, running, etc., has been stated to be as follows: First, the solar border of the wall; second, the bars; and third, the frog. In the foot that has never been shod the frog has nearly if not quite as much pressure in the full step as the wall. In rapid stepping, the edge of the wall, which is nearest the point of the coffin bone, receives the first force of the blow, while the frog, which mainly rests upon the elastic heels, a much more yielding substance, receives the weight as the foot settles back to its level. The effect of pressure is to flatten the arches of the commissures and cleft, to widen the frog, throw out the heels, and keep the foot freely expanded. The elasticity of the step of the horse is the result of a highly compound arrangement—first, the elasticity of the sensitive laminæ; second, the greater elasticity of the sensitive sole; third, the elasticity of the horny wall; fourth, the arch of the sole; and, fifth, the triple spring formed by the foldings of the frog and the manner of its union with the bars. The movements of the foot are produced by two sets of muscles, flexors and extensors, similar to the distribution of a single finger in man. The flexors are two in number, and are situated upon the posterior aspect of the leg. In the fore legs these muscles are the *flexor sublimis perforatus,* (Fig. 6, 6,) and the *flexor profundus perforans,* (Fig. 6, 7,) also called in works on farriery *flexor pedis perforatus* and *flexor pedis perforans;* also familiarly designated as the common and deep flexor muscles. These muscles take their origin in common from the internal protuberance of the humerus, and are united for a considerable distance down the arm, when they separate to form two distinct tendons. Of these, that belonging to the perforatus runs beneath the annular ligament of the carpus, to be inserted into the upper and back part of the lower pastern or coronet bone. Just before reaching the pastern joint, this tendon divides, to allow the tendon of the perforans to pass through it. Each division where it plays over the joint has in it a sesamoid bone. The tendon of the perforans, lying deeper above, passes between the divided tendon of the first-named muscle, to be inserted into the posterior concavity of the coffin bone. Attached to this tendon, as it passes over the joint formed by the coronet and coffin bones, is the navicular bone, considered as a sesamoid bone in this tendon. Two supplementary flexors, the accessores, are described as arising from the posterior and inferior aspect of the ulna and the radius, and uniting below with the two main flexors. These muscles flex the foot upon the leg. As antagonists to these, there are three extensor muscles situated upon the front of the leg, corresponding to the *extensor communis digitorum* and *extensor minimi digiti* of the human arm. The *extensor communis,* otherwise called in hippotomy *extensor pedis,* arises from the external condyle of the humerus, and from contiguous fascia, and from the upper and lateral part of the radius, and has a strong, fleshy belly, which terminates in a single tendon which passes down over the front of the leg to be inserted into the coronal process of the last phalanx—the coffin bone. It unites by a slip with the tendon of the next muscle. The *extensor proprius minimi digiti* is represented in the horse by two muscles. One of these, called the extensor of the pastern, is inserted by a strong tendon into the side of the first phalanx, the pastern bone. The second muscle, placed between the two preceding muscles, furnishes a strong tendon which passes down in front of the carpus and becomes united with the communis at an acute angle. The united tendon (Fig. 6, 5) passes behind the coronary border of the hoof to its insertion in the coffin bone. The office of these muscles is to extend the foot upon the leg. Another muscle, the *adductor longus pollicis,* called in hippotomy the oblique extensor of the cannon, by its insertion into the base of the cannon bone, acts as an extensor of the foot. A similar arrangement exists in the muscles of the hind leg. The tendon of the *plantaris,* of great strength, has a divided insertion corresponding to that of the *flexor sublimis perforatus* of the fore leg, while the *flexor perforans* sends its single strong tendon between the two divisions of the preceding muscle to be inserted into the terminal phalanx. These flexors of the foot are assisted by the tendon of the *flexor hallucis,* which unites with the tendon of the perforans. The extensor tendon of the hind leg, of great strength, is furnished mainly by the *extensor communis* muscle. The *extensor brevis* is represented by a few fibers which come from the cannon bone, and unite with the tendon of the *communis.* The united tendon passes, as the corresponding one of the fore leg (Fig. 6, 5) to its insertion in the coffin bone. The arteries of the foot are branches of the radial, in the fore, and of the tibial in the hind legs. The former descends along the radius, accompanied by the radial nerve, to a point a little above the knee, where it divides into the large and small metacarpal arteries. Of these the large metacarpal is the principal trunk, passing under the posterior annular ligament. While passing down the cannon bone it divides into three branches. The middle one is distributed to surrounding tissues, while the other two become the plantar arteries, internal and external. The plantar arteries of the fore leg result from a division of the metacarpal, and in the hind leg from a similar division of the metatarsal, and the terminal distribution is alike in both. They descend to the lower part of the cannon bone (Fig. 8) pass the fetlock joint by the side of the sesamoid bones, in company with veins and nerves of the same names, and pass into the substance of what is sometimes called the fatty frog. They then pass the extremities of the coffin bone and enter the foramina on the posterior concavity of the bone. (Fig. 4, *a, a, a, a*). The branches of the plantar arteries are very numerous, and no part of the body is more fully supplied with blood than the foot (Fig. 5). The veins of the foot constitute a very intricate net-work of vessels. The veins of the frog, the sole, the laminæ, the superficial and deep-seated coronary veins, unite to form coronary and plantar plexuses (Fig. 8), from which are formed plantar veins, which, by their union, constitute metacarpal and metatarsal veins, which lie anterior to, and by the side of, the plantar arteries. Dissection of the horse's foot is shown at Fig. 8: 1, general integument, turned back; 2, fatty mass, forming a cushion behind the great pastern joint; 3, wall of hoof turned back, showing the vertically laminated processes pro-

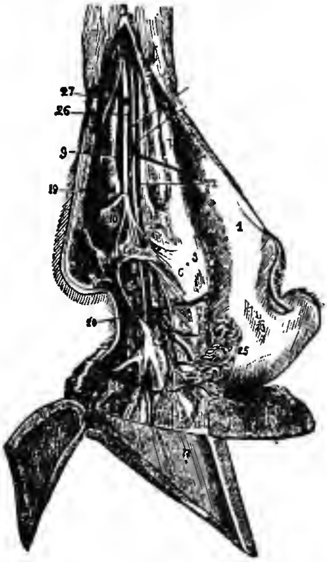


Fig. 8.

jecting from its inner surface; 4, section of wall of hoof; 5, the articulation between the cannon and pastern bones; 6, 6, 6, aponeurotic tissues; 7, 7, extensor tendon of the foot; 8, 9, 10, flexor tendons of the foot; 11, 12, 13, 14, 15, expansion of the great cartilage of the foot; 16, the coronary band raised from the hoof; 17, the vascular or sensitive hoof; 18, elastic cushion of the heels; 19, 20, 21, plantar artery; 22, 23, plantar veins; 25, part of coronary venous plexus raised from its position; 26, 27, 28, plantar nerves. The nerves of the foot are known by names corresponding to those of the blood-vessels which they accompany. The plantar nerves (Fig. 8) lie by the side of and behind the corresponding artery, and, as they descend into the foot, are distributed to the same organs and regions. The final branches enter the foramina in the coffin bone, minutely subdivide in it, pass through its many canals, and escape at the edges of the sole to the sensitive parts of the foot, in company with the terminal twigs of the arteries as shown in figure five.

HORSE-TAIL. The genera *Equisetum*, or scouring rush, and *Hippuris*, remarkable for the large amount of silica they contain. They grow in rich, wet places, and are of value for polishing.

HORTICULTURE. In defining agriculture, in another part of this volume, we stated it as embracing all that pertained to the working of the earth, dividing it into two great branches, husbandry and horticulture. This latter is again subdivided into pomology, vegetable gardening, the raising of nursery stock, floriculture and landscape gardening. These are the most elegant, as they are the most fascinating employments relating to agriculture. Horticulture is never practiced by man, until husbandry has become a true art, nor until such a state of civilization exists in a nation, as not only to call for great variety in the culinary art, but elegance and ornament about the homes of the people. Ancient horticulture was but crude as compared with modern, as was their civilization, if we except the unqualified superiority of Greek sculpture, and not until within the last one hundred years has horticulture become more than a crude art, either in the superior variety of fruits cultivated, the excellence of vegetables, or in the talent displayed in the adornment of the landscape. Horticulture, like agriculture, not only has its practical but its scientific sense also. The uniting of the practical with the scientific is what makes the finished workman in every art or profession in life. Thus, horticulture was divided by the late W. C. Flagg, one of the most eminent horticultural writers of the West, while President of the Illinois Horticultural Society, into distinct branches, and grouped together, from which we extract, (Illinois being implied, but which with allowances for soil and climate will do generally for the West): I. Useful, comprising Fruit Growing, which includes: orchard culture; vineyard culture; small fruits and their culture. Vegetable or market gardening, including vegetables cultivated for their roots or tubers, as potatoes, onions, beets, etc.; vegetables cultivated for their leaves or stems, as cabbage, asparagus, etc.; vegetables cultivated for their fruit, as tomatoes, melons, peas, etc. Tree Growing, including hedging; belts, or wind breaks; timber plantations and woodlands; nursery culture. II. Ornamental, comprising ornamental tree planting; flower gardening; landscape gardening. III. Scientific, comprising collections of fruits, vegetables, trees, flowers, and plants generally, made not so much for profit or ornamentation, as for experiment and to gratify a scientific taste. Horticulture requires special attention to the choice of soil and climate. The soil for nearly every horticultural product should be warm, deep, dry, and not too rich in humus, nor yet too sandy. The chief difficulties of tree growth in the northern part of the State and in States farther north, seem to be rather of the soil than of the climate. The soil, in some cases, is so loose as to freeze to the depth of six feet in hard winters, and very imperfectly protects any plant standing in it through the winter, whilst so rich as to start a late growth on very little provocation. Soil of a finer and closer texture would evidently be preferable in both respects. Our best soils, as a rule, are those of lighter color, on which forest trees are growing, or will most readily grow. The situation for all horticultural purposes should be as elevated as possible above the surrounding country, so as to avoid the late frosts of spring and the early frosts of autumn; and that the winds may have access during the humid, still heats of early summer, which are detrimental to most horticultural growths. It should be distinctly understood that the summer needs of the fruit tree and its fruits are plenty of air and sunshine. Horticulture demands foresight. The question of a market for one's products, of the varieties of fruit that will be profitable twenty years hence, but that must be chosen and planted this year; of the future effect of a clump of trees, and the prospective value of a given kind for lumber; these and many other points involving one's future prosperity and success must all be forecast by one who would proceed wisely and well. Lord Bacon said that, he who hath a wife and children hath given hostages to fortune. Hardly less is this the case with him who plants an orchard, a vineyard, or a forest. Horticulture, in all or nearly all its branches, demands very deep and thorough preparation of the soil for its best success. Shallow culture on most soils is to be deprecated in agriculture, much more so in horticulture, where the ground in some cases will not be replanted for many years, and where, in any event, the expense of seeding and culture per acre is much greater than in agriculture. But where deep preparation of ground is for any reason omitted, continuous stirring of the surface in clay soils, at least, has an excellent result, and probably for many smaller plants is a good, if not sufficient substitute. Of useful horticulture, fruit growing is the branch most attractive to the masses of the people, and perhaps, as a rule, the most profitable. Of these, orchard fruits comprise the apple, pear, quince, peach, nectarine, cherry, apricot, and occasionally other fruits growing on trees planted in order in a separate plantation or field. Of these we must say, in their favor, that once established they require comparatively little care in their after culture, and in many cases yield their fruit year by year gratuitously. On the other hand, they are less easily protected from sudden changes of weather than vines or shrubs, or from the attacks of insects and diseases. Of these orchard fruits, the apple is in most civilized countries the most important, and probably as ancient as any. It is found in the remains of the lake dwellings of the Neolithic period, apparently cultivated. The pear is also widely distributed, but gives evidence in a greater variety of names of having been domesticated by more different nations. But it seems less flexible in its organization, and in the New World, at least, not to withstand extremes of humidity and dryness, of heat and cold nearly so well as the apple. The quince may be grown at a profit, at least in small quantities, in the damper and richer soils. The success of a few, and the fact that it blossoms late and so avoids frost, would seem an argument that it can and will be more extensively grown in the years to come. But if so, it should be grown as a bush, and not with a trunk. The peach, south of 40° at least, is sufficiently hardy to be cultivated with moderate profit in many localities, and in some places large returns may be realized. This fruit, which is referred to by Confucius, and also, says De Candolle, mentioned as early as the tenth century before Christ, is believed by later authors to be a modified form of the almond. For growing the peach the most favorable points should be selected; such as the heights of the bluffs along our great rivers, the tops of the hills, the mounds, and other elevated points. The varieties having large blossoms seem to be almost invariably the hardiest. The cherry, in one or more of its varieties, is grown throughout the State, and occasionally with considerable profit. The hardy varieties of Early Richmond and Common Morello may be grown almost anywhere and under great neglect. The sweet cherries can be grown in many localities where the subsoil is open and the upper soil not too rich. But the cherry needs a cool summer for the best results, and the buds of the sweet cherry are often nipped by the frost. The plum is quite tender in the bud, except in the Chickasaw, from whose varieties we may expect our best and most complete success in plum growing, just as we have found to be the case with native rather than foreign grapes. Vineyard culture has been wonderfully advanced, both by the discovery and dissemination of more reliable varieties, and in a better teaching and practice of modes of culture. The grape is a profitable fruit, but demands inexorably high culture, timely pruning, training, and pinching. Yet, its culture is specially attractive to the cultivated taste, and remunerative to the good manager. The American grape is a fruit of wide range. The frost grape grows as far north as latitude 50°, three degrees farther north than Quebec, on the Saskatchawan; and the Southern Fox and summer grapes extend down quite to the southern extremity of the United States. Consequently, if we can guard against some of the extremes of cold, which are injurious to the vine, by covering with loose earth, or even laying close to the ground, and can secure the leaves and fruit against the cool nights and hot humidity of the growing season, we can grow grapes nearly everywhere. Our continental climate is one of great extremes. Humboldt, in his Cosmos, intimates that we are fated, as Dante says in the third canto of the Purgatorio:

> To suffer torments both of cold and heat,

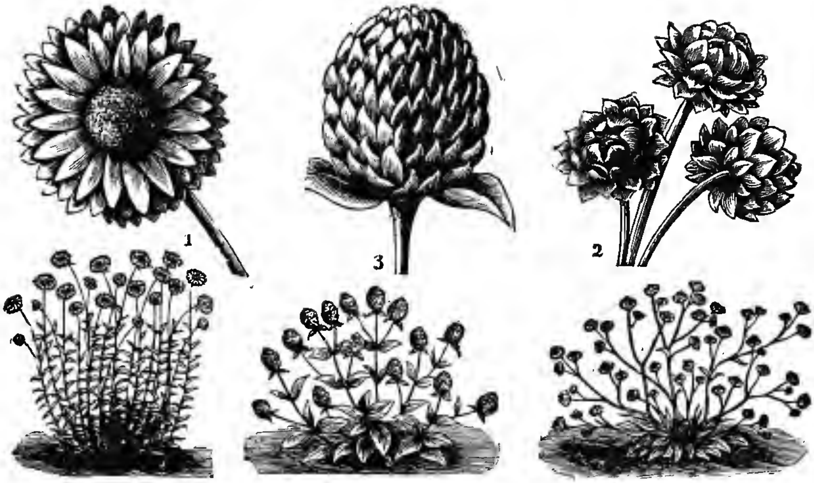
or, as Milton has it, condemned

> To feel by turn the bitter change
> Of fierce extremes: extremes by change more fierce.

We can not fully guard against these extremes, especially the saturation of soil and atmosphere that sometimes takes place in the season of most rapid growth. It is a curious fact, by the way, that some of the finest fruit is grown in these regions of greatest extremes. The finest apples of Russia are said to come from the Crimea, where the thermometer goes up to 100° of summer heat, and the cold of winter is intense. The like is true of the finest fruit countries of Asia, which are all, presumably, continental in their climates. The small fruits, including under that name the strawberry, raspberry, blackberry, currant, and gooseberry, (and we might include the cranberry and whortleberry,) are in many respects desirable and valuable crops. The strawberry, from its early returns, fruiting heavily one year from planting, is a desirable crop for the person of small means, or for any one desiring early returns. As it is a low plant, its conditions can be more easily controlled than those of any other fruit by mulching or covering. The raspberry and blackberry bear some fruit in the second year, sometimes amounting to a good crop, and are desirable for that reason. The currant and gooseberry come later into bearing, and are valuable chiefly for their involving small expense in culture and being hardy and productive, rather than high-priced. The strawberry is, without doubt, the most valuable of the small fruits, and the raspberry least so. Vegetable or market gardening near the cities and large towns and to a certain extent where there are good facilities for shipping, is a remunerative though a laborious business, and is associated to a certain extent with fruit growing to advantage. In many cases it borders close upon ordinary agriculture. But in many instances again it requires the best skill of the horticulturist for success. Vegetables grown for their roots or tubers are such as the beet, carrot, onion, parsnip, potato, radish, ruta-baga, sweet potato, and turnip. Vegetables grown for their tops or stems, are such as the asparagus, cabbage, cauliflower, celery, and rhubarb. Vegetables grown for their fruit are the bean, corn, cucumber, egg-plant, melon, pea, squash, tomato, and watermelon. Tree growing, for timber and other purposes, comes late in horticultural progress, and does not look to very immediate results. Yet the attention given to it by governments and individuals in the Old World, evinces its importance and warns us to provide for the future of our own country. We should have trees growing on every declivity too steep for profitable cultivation, and on the west side, at least, of every farm. Hedging, under the impetus it has received from the high prices of fencing, and from the better knowledge of its management is getting on satisfactorily, and the abundant and cheap supply of Osage Orange plants, is fast surrounding our prairie, and even our forest farms with a living wall. The Osage Orange is the surest, and, so far north as its culture can be safely carried, seems to be the best. Very beautiful as an ornamental hedge, and perhaps sufficient for a fence, is the *Pyrus Japonica*. As in other horticulture, deep and thorough preparation of ground, careful planting, and clean cultivation are prime necessities. Belts or wind breaks have been highly extolled and somewhat planted in our prairies. For these belts immediate utility and rapid growth are generally prime requisites, and hence trees of an inferior quality of timber, such as the soft maple, cottonwood, white willow, etc., are planted. But it is evident that evergreens and some of the better deciduous trees should be planted under their lee, to finally replace them. Ornamental horticulture, though very attractive, of course, makes comparatively slow advance in any new country. It appeals to the æsthetic part of our nature, and, therefore, can only receive due attention after hunger is satisfied, and the more immediate necessities of life provided for. Ornamental tree planting, with the exception perhaps of some faint attempt at flower growing—the pathetic effort of a wife or daughter to redeem the arid desert of a corn and hog-grower's front yard, naturally comes first. An ornamental tree or shrub, in a farmer's eye has the immense advantage after once established, of taking care of itself. In ornamental tree planting we may plant many trees not very valuable on account of their beauty of form or foliage. The white elm is a conspicuous example of this kind. The linden is one of the finest, and the white and burr oak are magnificent species, combining the picturesque with the beautiful. The study of these trees, singly and in mass; their characteristics of height and outline; shape of foliage; its shade of green and its autumn colors, as well as the effect of their blossoming, are important as preliminary to the grouping and contrasts of landscape gardening. As a rule, trees of heavy foliage and dense shadow, like the catalpa and linden, with pendant rather than horizontal spray, as the white elm and the willow, and of varied tints, as the locust, in the different shades of its younger and older leaves, or the sugar maple in its change from summer to autumn hues, are most admirable for planting singly. Flower gardening can only be commended in its results. Modern art has compassed the globe, and brought to our homes the floral treasures of ancient Asia and the isles of the sea. But flower culture, attractive as it is to the more refined tastes of woman, and all who sympathize with her, commends itself to us as one of the most innocent of amusements, and one of the most instructive and refining of pursuits. It has too—though that seems little thought of, its market value; and the increasing demand for flowers by those who can not or will not grow them, will give an added interest to the occupation. Landscape gardening may be said to include the whole, of which ornamental trees and flower culture are parts. Here we bring under consideration the configuration of the surface; the surrounding landscape; the effects of grouping and massing trees, shrubs, and flowers of different colors and shades of color; the massing of single colors, and uniform outlines, and one knows not how many intricate æsthetic questions. For landscape gardening is painting in living colors. Longfellow addressing the children at their play, said

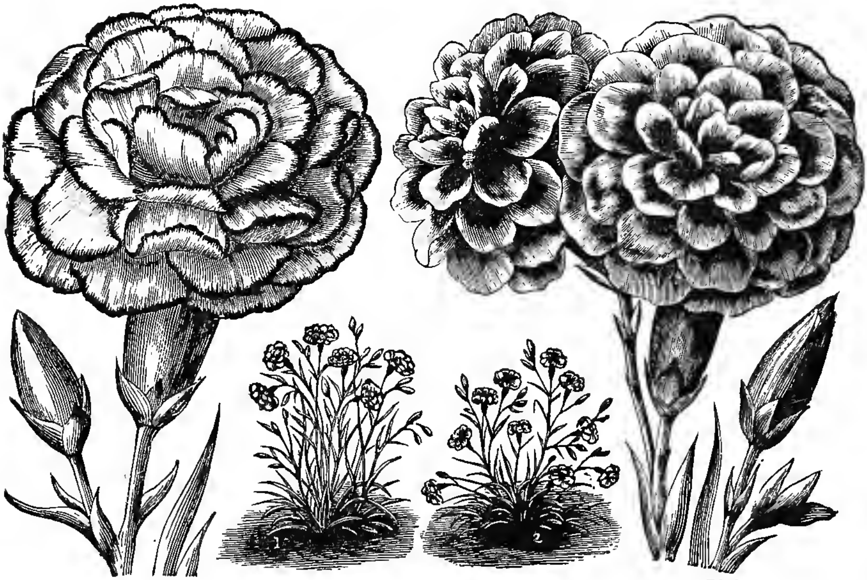
> Ye are better than all the poems
> That were ever sung or said,
> For ye are the living poems,
> And all the rest are dead.

Landscape gardening is better than the painter's work in the same way. It is the reality of which the other is but the shadow. And, though the breadth of surface and the means of carrying out its more elaborate designs are generally beyond private means, there is yet a great neglect of what might be done easily and cheaply, with only a little foresight and thought. A little clump of trees planted on an eminence, costs but a few dollars, yet it may be a point of beauty in the landscape, for a lifetime. A chance elm that has sprung up in a distant corner of the farm, may be staked about and protected in a few minutes time, yet hangs like a green cloud on the horizon for long years to come. Still more will a little work effect great things in the clearing of woodlands. The trees that may be saved, and in one way or another made to subserve the adornment of a home, are grown for our purpose and we gain a generation's time, and see with the eyes of our children. Scientific horticulture is carried on with the primary purpose of increasing knowledge. It aims at the truth, whilst ornamental horticulture seeks the beautiful, and useful horticulture the good. Collections of trees form an attractive pursuit. Arranged botanically, even a single straight row of trees, representing the more common and hardy species, may be made instructive. In conclusion, Mr. Flagg says: In all time, horticulture has been the favorite pursuit of the more advanced races and of the foremost men. It was, we are told, the occupation of our first parents, and our second ancestor planted a vineyard, if he did not make an altogether commendable use of the product. The hanging gardens of Babylon were the wonder of the ancient world, and the sculptures of old Egypt reveal the esteem in which the art was held in that dim and distant time. The Homeric poems with their Garden of Alcinous, whose fruit never perishes, nor does it fail winter or summer, lasting throughout the whole year; but the west wind ever blowing makes some bud forth and ripens others—their Isle of Calypso, where four fountains flowed in succession, with white water, turned near one another, each in different ways, but around there flourished soft meadows of violets and of parsley—bear witness of other and ancient days, as did Theocritus, and Virgil, and Horace, in their time. It was Lord Bacon who said: God Almighty first planted a garden, and, indeed, it is the purest of all human pleasures. It is the greatest refreshment to the spirits of man, without which buildings and palaces are but gross handiworks; and a man shall ever see that when ages grow to civility and elegance, men come to build stately sooner than to garden finely, as if gardening were the greater perfection. Thomas Jefferson—one of the greatest and certainly the most influential in his own and subsequent generations of American statesmen, whose declaration of the absolute equality of man hung on the horizon like the mene tekel upharsin on the wall of the feasting Belshazzar, and won the battles of the second as well as the first revolution—kept a record through the eight years of his presidency of the first appearance and the disappearance of the various vegetables in the Washington markets, and spent his rural hours at Monticello in gardening. Our veteran poet, Bryant—it seems to run in the family—delights in tree planting, and wrote the poem, The Planting of the Apple Tree. Hawthorne, Emerson, Lowell, Mitchell, and many others, living and dead, of our eminent men, have a warm side toward horticulture. Thus, says



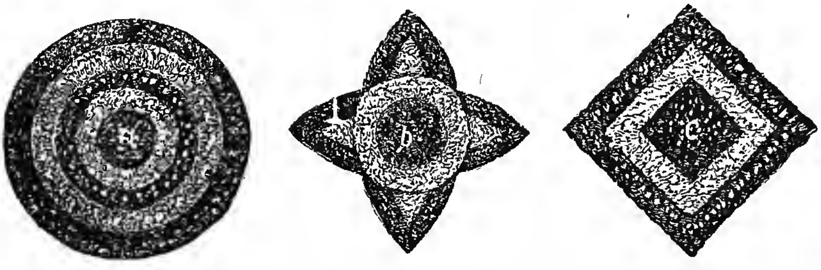
1, Acroclinium. 3, Gomphrena. 2, Ammobium.

EVERLASTING FLOWERS.



Picotee. Garden Pink.

CARNATION-LIKE PINKS.



FORMS OF FLOWER BEDS.

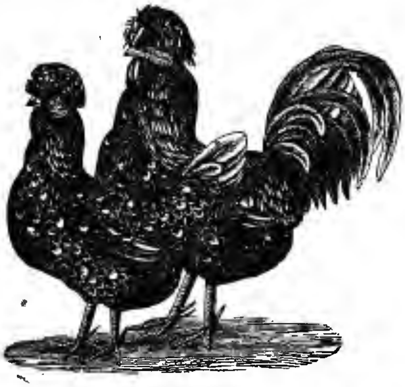
Alcott in his Tablets, we associate gardens and orchards with the perfect condition of mankind. Gardeners ourselves by birthright, we also mythologize and plant our Edens in the east of us like our ancestors—the sacredness of earth and heaven still clinging to the tiller of the ground. Him we esteem the pattern man, the most favored of any. His labors have a charming innocency. They yield the gains of self-respect denied to other callings. His is an occupation friendly to every virtue; the freest of any from covetousness and debasing cares. It is full of honest profits, manly labors, and brings and administers all necessaries, gives the largest leisure for study and recreation, while it answers most tenderly the hospitalities of friendship and the claims of home. The delight of children, the pastime of woman, the privilege of the poor man, as it is the ornament of the rich man, the praise of the scholar, the security of the citizen; it places man in his truest relations to the world in which he lives. He who is insensible to these must lack some chord in the harp of humanity, worshiping, if he worship, at some strange shrine. In conclusion, let us look for a moment at the relation of agriculture to horticulture. Some years ago, the editor presented the subject before the horticulturists of Illinois, in an address, from which extracts are made, as embodying his ideas now as then, and is as follows: The wild man is a brute, the educated one is a God, as pagans understand the term. The first subsists in a precarious manner upon such animals as he may overcome in the chase; but the second harnesses even the elements, and makes them subservient to his will. Both possess bone, sinew, muscle and blood, nerve and brain. The wild man acquires fair proportions, but the brain force is latent. The educated one, however, has fed both his physical and mental nature, and therefore is in the full stature of a man. In rising to a state of barbarism, the savage gathers flocks and herds, cultivates the soil in a rude way, and begins to fix his habitation. Emerging into civilization, art is developed. Enlightenment ensues. Science is born. Brain force becomes superior to physical power. The printing press stores up the knowledge of foregone generations. The flint and steel of mind upon matter knock out scintillations, illuminating the pathway of mankind, assisting one and another in the study of the material and the spiritual in nature. The savage becomes first the herdsman, then the husbandman; soon the arts of horticulture follow, and lastly come beautiful flowers and landscape adornment. The sum of these is agriculture. The poetry of agriculture is horticulture, and beautiful flowers are the religion of agriculture. A mere husbandman may know nothing about horticulture. A horticulturist may know but little of husbandry, but he must necessarily know a good deal about agriculture. An agriculturist must understand all. The farm destitute of some adornment looks sorry and cheerless indeed. The villager's house, with its little parterre and vine-clad bower, pleases and cheers the passer-by, while the costly and naked magnificence of the citizen's mansion is scarcely regarded at all. But if, in passing along a country road, you come to a farm where the wealth of the owner has enabled him to beautify and adorn the landscape and rural surroundings, the exclamation at once comes forth—How lovely! How beautiful! The farm after all is the place for effective landscape adornment, and the farmer who is a horticulturist as well may add much, and at comparatively little expense, to the attractiveness and beauty and comfort of his home. He perhaps moves into a new country, poor enough,—his team, household effects, honest hands, and a quarter section of wild prairie, his all. He ploughs, sows, reaps, feeds cattle; this is husbandry. Of timber there is none. He prepares his rows and plants hedges for fencing, nuts for timber; grafts and buds, strikes cuttings, and rears orchards and vineyards. Curves a drive-way winding about his buildings and offices; makes a lawn shaded by spreading elms and lindens, with here and there other deciduous and evergreen trees; leads the streamlet into the hollow and forms the lake; builds, with advancing wealth, a green house, a conservatory, an aboretum. This man, and only this, is an agriculturist. There are many farmers, who if, as they were growing rich, had devoted some of their money and leisure to these subjects, would not now be lamenting that they had not sooner commenced to be agriculturists instead of mere farmers. We only need to remember that the finer the production, the more care should be bestowed upon it. That the delicate fruit or succulent vegetable forced into an abnormal condition by high cultivation, can not be expected to continue to improve or even hold its own without continued high culture and care. We pay high prices for new wheat, rye, barley, oats and corn, from year to year, and yet after a few seasons of cultivation they become as the old sorts. It is because we have not given them the same cultivation that they had previously received to bring them up to the selling and actually to the economical standard. A man plants an orchard, turns in his cattle to trim it, and his hogs to cultivate it, and feeds it, as he does his cattle, on grass. It is not strange that his orchard is unproductive, and he thinks his is not a good fruit country; while, if the facts were known, there are but few farms in the West but what might produce what fruit is consumed, which is also hardy in their climate; and yet how few farms at the present day in the West produce their own fruit, and at the same time how difficult it is to find any section of the country, but that some farms in them produce fruit, and in abundance! It is simply because we do not give enough attention to diversified agriculture; we either run all to stock, or grain, or fruit, or some one of the principal productions of agricultural art—while more variety in our crops would give greater exercise to the mind, and more varied enjoyment as well, Oh! that the farmers of America might wake up to the great possibilities that lie before them; that our rural youth would study those sciences that pertain to agriculture, the mysteries of vegetable physiology. Why the same air, earth and water produce sound grain or smut, perfect fruits or loathsome corruption. The simple and certain means which nature uses to convert noxious and deleterious matter into plant food. To find the means of attracting to the soil or plant, decomposing and rendering useful at will the latent elements, in air, earth and water. That the earth from becoming more and more barren each year, or relatively, in other words, losing the power of absorption and assimilation, shall grow fatter and fatter, more and more productive, until it shall be again re-instated in its original fertility. If the problem of a higher social existence is solved, it must be solved by applying science, practical science, to industrial pursuits, and which must be founded upon the dignity of labor. The present generation want to reap some benefit from agricultural education. How shall this be done? First, by lectures upon practical agriculture, the management of the farm, orchard, and other rural pursuits, rotation of crops, improvement of seeds, stock breeding and rearing. Management of the dairy, and all that pertains to in-door farm life. Surface and under-draining, their principles and effects. Mechanical and chemical action upon soils. Cultivation of timber. How climates are changed by the settlement of the country, and what may be done to bring it into a more equable condition. The phenomena of atmospheric and aqueous influences so far as we know them. Upon the propagation, rearing and pruning of fruit trees, shrubs, and vines, their habits and culture, gathering, marketing, and use. The forcing cultivation, marketing, and uses of vegetables. The cultivation of ornamental, medicinal and flowering plants. Glass and other structures for forcing. Landscape gardening, rural architecture and ornamentation. Upon the sciences connected with agriculture, their uses and appropriate places so far as discovered. The mapping out and recording upon experimental farms, gardens, and in proper structures, from year to year, of all that is new in agriculture, horticulture, and floriculture. Experimenting, from year to year, upon improved methods of cultivation, and acclimating, instituting comparisons, and reasoning therefrom—the chemist, the botanist, the geologist, the entomologist, the veterinarian, and other professions, down to the humble delver in the soil, being actuated by one motive—the advancement of agricultural science—which, disseminated throughout the land by means of the public press, finds its way to every fireside in the country; while at the same time the young men appointed to enter the different classes in our agricultural schools, will gradually eliminate the dross from the pure metal, and give us something else besides that obnoxious word, empiricism, which we translate, quackery — the pretensions of ignorant men to skill. We have happily supposed that agriculture was somewhat scientific; we had supposed that intimately connected as it was with chemistry, botany, and kindred sciences, that it must necessarily partake somewhat of science itself. But, alas! this agriculture, which in itself is really the sum of all science—the science of life—toward which every known science, more or less, intimately tends, is looked down upon. Why should it be? Every fact in nature, which is constant, is science. Any certain knowledge is science. Bakewell and the Collings were scientific stock breeders. The fruit grower who saves his crop under adverse circumstances, by the application of certain knowledge, is scientific. So of the husbandman. The florist is decidedly scientific, who forces plants to bloom in an artificial atmosphere, under artificial conditions; and so also is the landscape gardener, who makes a paradise of a desert—even pure science, as mathematics, must enter here. (See pages 689 and 1113.)

HORTUS SICCUS. An herbarium, a collection of dried plants.

HOT BED. The laying up of heated manure or other vegetable substances, which will ferment in such a manner that heat will be given up slowly, continuously, and for a considerable length of time, is termed a hot bed. The bed or beds are then surrounded by a frame, and covered with sashes filled with glass, for the double purpose of drawing the heat of the sun and retaining it, and also the heat of the fermenting manure. Market gardeners in the North, when lettuce and that class of plants are to be forced all winter, make the walls of their beds permanent, double, and lined with tan bark. A situation being selected, so the bed may be sufficiently underground, and so the sash will be just above the surface on the lower side, and about four or five inches higher at the back. In these the young plants are pricked out about the first of December, and successively as they mature for market. Upon the farm, the first of March is time enough to construct the hot bed. Select fresh manure from the horse stable, long and short together, and lay it into a compact heap near where you want your bed, and in sufficient quantity so it will be about sixteen inches thick when properly laid and compacted in the bed. If, at the end of three days, it throws up a strong heat, turn it over evenly, and again put it in a compact heap. If it still shows a rank heat, turn it again; if not, it is ready for use. If the land is dry, so that no water ever stands within two feet of the surface, excavate to the depth of a foot, and a trifle larger than the dimensions of the frame, throwing the most of the earth to the back of the bed. Upon some still day proceed to lay the manure in the bed, shaking out all hard lumps, patting it down from time to time with the back of the fork, to discover the soft places, and keep all uniform. So proceed until you have the bed finished. Put on the frame, cover the manure with three inches of the best soil you have; place the glass on the frames, and, as soon as the heat begins to rise, add five inches more of rich, friable soil. When the thermometer shows a heat of 70° or 80°, the bulb being placed in the soil, the bed is ready to plant. The frame may be made of rough boards,—the back six inches higher than the front, to allow the water to pass freely off the glass. The frame should be nailed to two-by-four posts at the corners, and stayed at proper intervals by nailing a strip two inches high by one inch wide on an inch strip three inches wide,—the last made flush with the top of the frame. These will make way for the sash to rest and slide upon. The sash should be made of the best clear two-inch stuff, and to accommodate four rows each of eight-by-ten glass. No cross-bars should be allowed,—one light of glass being lapped over another, commencing at the bottom and working toward the top. The glass should be well tinned and puttied, and the sash should have not less than two coats of good paint. The soil excavated should be used to bank against the frame, even with its top, and, if the soil is wet, the bed must be made entirely above ground; in which case, the manure must be laid a foot wider, all around, than the frame, and the whole banked up with manure flush with the top of the frame. The day heat, when it rises, should mark about 70° or 80°. This temperature you can raise or lower at will by keeping the glass close, or giving air. The temperature for cabbage, cauliflowers, lettuce, radish, celery, and other hardy plants, should not be greater than about 70°. For all tender plants, as the egg-plant, tomato, melon, pepper, cucumber, etc., the heat may go to 80°. At night the temperature should not go below 50°, although 40° or lower will not injure hardy plants. Before sowing the bed, the earth must be raked in the nicest manner, throwing out all lumps, however small, and bringing the soil perfectly smooth and into fine tilth, and with a slight descent from rear to front. Proceed to sow your seed in regular drills, two and one-half or three inches apart. Sow thickly, for the surplus is easily thinned out, and you can not afford to have a poor stand. Cover the seed heretofore named, except cucumber, about three-eighths of an inch, and cucumber one-half inch, deep. Water well after sowing, from a pot with a fine nose, so as not to drench or wash the surface, sufficiently so the water will reach the bottom of the soil, and yet not run down into the manure beneath. Sow all seeds of hardy plants, following one after another, so that the hardy and the tender sorts may not be together, for the hardy must have more ventilation and much less heat than the tender. The ability of plants to stand cold, beginning with those most hardy, is as follows: Radish, cabbage, cauliflower, lettuce, celery, tomato, cucumber, and egg-plant. This latter is injured by a temperature much below 50°, and either of the three preceding will be killed by white frost. Always have your drills run across the sash—never lengthwise. Water always with tepid water, or with that about the temperature of the bed. Water often and lightly while the plants are young, and more seldom and more heavily as they attain age and size; and preferably, in the afternoon, when the glass is to be closed for the night. Remember, in watering, that the heat of the soil, the ventilation, and the leaf-surface of the plants, combined, are the measure of the evaporating power. Give air at all favorable times—always, however, avoiding a direct current upon the plants. This may easily be done by tilting the sash against the wind, rather than toward it; and the stronger the force of the wind, the less will be the opening needed for ventilation. In fact, when the wind is strong, little or no ventilation will be required during the early part of the season. Close the bed early so the heat may be raised sufficiently to carry it through the night; and, unless safely protected, against dogs, shutters must be used in addition to the other covering at night. Straw or cane mats are the best covering, but slough-hay, laid over the glass and held in place with boards, is clean and easily raked off. After raking, the glass should always be swept with a broom. Thus we have protected extensive ranges of glass from frost, getting a full supply of lettuce and other vegetables from February until they could be raised in the open air. Rain must never be allowed to fall on the soil of the bed, except it be, perhaps, late in the season when the weather is fairly settled; and it is better not then, since the bed is always much warmer than the atmosphere, and there is danger of chilling the plants and drenching the soil. Weeding the bed and thinning the plants must be done with the thumb and forefinger, and nothing more will be needed for loosening the earth between the rows than a steel-tined fork and a table-knife. Thin the plants before they are crowded, to about half an inch apart. This is essential, since, if it be not done, your plants will draw, and will become spindling, and weak. Once they get drawn it will be difficult thereafter to make them again strong. In this connection, it will be proper to say that the closer you can grow the plants to the glass the better. It is usual, when the bed is planted, to have the glass about ten inches above the earth. This is a good distance, and if provided for, it will not be necessary to raise the sides of the frames, to give more room, until the last transplanting, when this becomes necessary, the whole, frame and sashes, can be pried up, and suitable blocks laid underneath at proper intervals. We advise that you buy tomato, egg-plants, etc., if possible, of some market gardener. If so, take them when the plants are about two inches high. Twenty-five to fifty, each, of tomato, peppers, and egg-plants will be sufficient. One hundred and fifty celery plants will also be ample for an early supply of this vegetable. The others named heretofore, and such as you may wish, you may easily raise yourself. To prick out plants in the bed, take an inch piece, three inches wide, and of a length so that it will easily go in the bed when a sash is removed, or, say, a little shorter than the width of the sash. Along one edge bore three-eighths-inch holes, two and one-half inches apart, and along the other edge bore holes of the same size three inches apart. Into these holes fit pins to project three inches. This is your marker, and will enable you to plant correctly two and one-half and three inches apart; or double these distances, prepare, also, a board, a foot wide, that will go easily into the bed,—this to stand on while planting. Have also pieces of siding, five and six inches wide, and you are ready for planting. Put in the wide board to stand on; lay down the five or six-inch strip, as the case may be, six inches from the rear of the bed; draw a light drill as a guide on each side of the strip; turn the strip over twice, mark again, and so prepare six drills. With the marker, press the holes for the plants, and, if the plants are to be two and one-half inches each way, make intermediate marks between those already made. The plants for pricking out are best kept in a basin of water, since it insures their remaining fresh. Take a plant by the top; drop the root into one of the holes, a little deeper than it naturally grew, commencing at the left side of the bed,—enlarging the hole for the plant, if necessary. Press the earth about the root, by inserting the forefinger of the right hand just beyond the plant, and pressing to the plant; or make a pointed dibble of the proper size, with which to enlarge the holes, and press the earth to the plants, thrusting it somewhat diagonally, and below the bottom of the plant, in pressing the earth to them, being careful to get the earth firmly about the roots. Water as you proceed, and shade from the sun, always selecting a mild, still day for the work. When one sash is planted, cover close with the glass, and give no air until they cease to wilt under the sun. Cover with a piece of thin muslin, or a little hay, so as to admit light, but not the direct rays of the sun, and you will soon have your plants growing nicely. All this may seem tedious, but it is more quickly accomplished than described; indeed, an expert hand will plant about as fast as one can count. Economy of space in forcing plants is a matter of especial importance. After a due knowledge of the proper conditions and treatment of plants is acquired, the next thing of consequence is this question of distances at which plants shall be grown. Lettuce is the principal crop raised. It is not only a fashionable salad, but also one of the most grateful to the palate. Five inches each way between plants is ample, and will give milder and more succulent heads than will a greater distance; and yet the most of gardeners persist in giving six inches, and many of them even eight inches of space. Let us figure a little on this: A sash six feet long by three feet four inches wide will give 2,880 square inches. Plants five inches apart will occupy, each, twenty-five square inches of space. Thus, in a sash, you may get 115 plants. At six inches apart, you get eighty plants; and at eight inches apart, you have only forty-five plants. Thus you have more than two and a half times the number of plants at the lesser distance than you have at the greater. And, of course, you increase the value of your glass nearly in proportion to these distances. So, where the one system might actually run you in debt, the other would give you ample profit. So with all other plants. The closer you grow them, transplanting always before they crowd each other, the greater the profit.

HOT-HOUSE. A general term for glass structures used in gardening and including greenhouses and conservatories. (See Greenhouse.)

HOUDAN FOWLS. This is one of the French breeds introduced into the United States. In France, the Houdans are held in as high estimation as are the Dorkings, in England, being noted there for the excellence and quantity of eggs laid, and as excellent in their flesh. They are supposed to have descended from the Dorking and Padone fowls, and, like the Dorkings, they should have the fifth toe. This characteristic is not constant, but is required in all fowls for exhibition purposes. The color is white and black, evenly mixed. Occasionally stained feathers will appear, but red ones should never be tolerated. The head is crested, the comb double-leafed, giving the birds a rather fierce look, which is heightened by the whiskers and beard, growing well up on the face of both cock and hen. The legs are spotted leaden gray, and the weight of the fowls medium. Altogether, there are many inferior breeds to this one, and they are certainly as handsome as they are agile, and able to take care of themselves. The other French breeds are Creve-cœurs, handsome, and a heavier breed than the Houdans, short-legged, easy fatteners, and steady layers. Both cock and hen should be entirely black, the head crested, the comb distinctly forked, sometimes antlered. The La Fletch has been called a Malay in height, a Spanish in color, and a Dorking in size. They are firmly knit, legs long and strong. The body is angular, rather than round, and very closely feathered. A peculiarity of this breed is a spike of feathers placed behind the comb, appearing like a double horn, and peculiar dwarf protuberances between the nostrils, which are much expanded. The wattles are long and pendant, the ear lobes large, white, and opaque. The general color is black, the breast, wings, and upper tail feathers, and hackles, reflecting violet and green-black. Legs, slaty blue. The Guilders are sometimes called French fowls, though they are from Holland, as their name denotes. There are white, black, and cuckoo varieties, all medium-sized fowls with prominent breasts and flowing tails. The legs are partially feathered, the wattles long and pendulous, and the head with scarcely any comb. The plumage is close and compact, and the thighs well covered and vulture-hocked.


HOUDAN FOWLS.

HOUND. Dogs of chase are so called.

HOUND'S TONGUE. The genus *Cynoglossum;* rough-leaved weeds of little value.

HOUSEHOLD. The members of a family, and those who dwell under the same roof, including laborers and servants. In agricultural pursuits the household are naturally drawn closer together, and live nearer on terms of equality, than do the servants in any other industry or condition in life. In agriculture, they are generally not servants in any other sense, except that often they do more of the ordinary labors of the farm and house than the master and mistress and the members of the family. Upon the average farm this labor is divided pretty equally among all, and the help often mingle, in many respects, upon terms of perfect equality.

HOUSELEEK. Exotic plants of the genus *Sempervivum,* with succulent leaves, which are mucilaginous. Some of the Sempervivums are valuable.

HOVEL. A shed for farm stock.

HOVEN, HOOVE. (See Blown.)

HUCKLEBERRY. (See Whortleberry.)

HUMATES. Salts of humic acid. (See Humus.)

HUMECTATION. Moistening.

HUMERUS. The upper bone of the arm.

HUMIC ACID. (See Humus.)

HUMIDITY. (See Meteorology, Rain, Dew, Moisture.)

HUMIFUSUS, HUMIFUSE. Spreading over the ground, procumbent, like the stem of the melon, sweet potato, etc.

HUMILIS. Low, humble, applied to small species.

HUMMING BIRD. The humming birds of America are, to this continent, what the sun birds are to the Oriental countries they inhabit, beautiful and brilliant creatures of the air. The most brilliant of the family are natives of the tropics, the principal species visiting the North being the Ruby-throated humming bird, (*Trochilus colubris.*) The humming bird was formerly supposed to live entirely on honey. Such, however, is not the fact; its food is largely made up of minute insects always found in flowers, which it takes with its tongue. Dissections of the stomachs of these birds show this fact. Only seven species are known to inhabit or visit the United States. These are the Ruby-throat, common everywhere North in summer; the Mango humming bird, found rarely in Florida; the Broad-tailed Flame-bearer, of Texas and Mexico; the Purple-throated, the Anna and Coste's humming bird of California and Mexico, and the Nookta Sound humming bird of Oregon and the Northwest coast. They are all insectivorous, and the most beautiful of our feathered tribes.

HUMOR. In anatomy, fluid secretions natural to the eye, or other parts of the body.

HUMUS. Finely divided organic matter, found in rich soils, not so much directly nourishing to plants, but which has the power, under moisture and heat, of rendering matter soluble. (See Soils.)

HUNDRED WEIGHT, or **CWT.** 112 pounds avoirdupois. In the United States 100 pounds is a hundred weight.

HUNGER-ROT. Disease occasioned in sheep by bad keeping or starvation.

HUNGRY SOIL. Poor, sandy, or gravelly soil, requiring frequent manuring.

HURDLE. A light, movable fence of wood, iron, or wire. Hurdles are made in sections and moved on the pasture as occasion requires.

HUSBANDRY. That branch of agriculture which includes the raising of farm crops, stock, the feeding and fattening of animals, dairying, etc., is denominated husbandry. (See Agriculture.)

HUSK. The dry exterior of fruits.

HYACINTH. All the varieties of this favorite flower are seedlings of *Hyacinthus orientalis*, a native of the Levant. Since its introduction into cultivation, about the year 1590, new varieties have become innumerable, both single and double, and of great variety of color and exquisite perfume. For out-door blooming the bulbs should be planted in October, and have a covering of mulch during winter, to be removed in the spring, and again given each succeeding winter. The bulbs should be taken up once in three years, separated, and again planted immediately. For winter blooming none but the finest dry bulbs should be selected. These should be potted in four or five inch pots, and placed in a half light cool cellar, until they show the beginning of the flower spike, when they should be brought to the heat and light. For succession, they may be potted every ten days. Thus they will begin to bloom before Christmas and give succession until spring. After the bulbs are brought to the light, water liberally and remove the offsets, if extra fine bloom is desired. The bloom having disappeared, withhold water, let the bulbs ripen, and save dry for next winter's blooming. They are also grown in hyacinth glasses, in water, but thus the bulbs are destroyed and the bloom is not so fine.

HYALITE. A variety of glassy quartz of a gray or yellowish color, and concretionary.

HYALOID. A transparent membrane.

HYBERNATION. The torpid condition in which numerous animals and reptiles exist during winter; they usually retire in a fat state, and become very lean by spring, the fat being consumed in maintaining the temperature necessary to preserve life.

HYBRID. The offspring of two animals or plants of the same genus, but of different species. As the ass and the mare, the buffalo and cow, the cashmere and common goat, etc. Cross breeding is the progeny between varieties of the same species, as between the race horse and the ordinary breed of a country, or between the Devon and Short-horn, etc. (See Hybridizing.)

HYBRIDIZING. Hybridization has, of late years, come to be a distinct branch of agricultural art, in the production of grains, plants, fruits and flowers. In animals, it has been practiced, in the production of mules, between the ass and mare, the buffalo and cow, Brahmin bulls with Short-horns, Alpacas with the Llama, the dromedary and camel, the common goat with the cashmere. So far, however, the results have not been valuable, if we except the mule proper, and the progeny between the male cashmere and the common goat of the country. The plan of proceeding is too simple to need explanation, except that the male animal should be used, to which the progeny is desired to most resemble. The progeny between the ass and mare gives a valuable mule; that between the horse and hinny, does not. Hybrids are not fertile as to the progeny. Hence, in the hybridization of plants, the progeny must always be propagated by layers or cuttings. The same is true to a great extent in the cross-breeding of plants, the seed can not be depended upon to come true. Indeed in hybridization there is always degeneration to a certain extent, so that in the majority of cases greater care is necessary with the hybrids than with the original parents. In vegetation, in the United States, hybridization and cross-fertilization has hitherto been chiefly confined to the grape, strawberry, and to flowers. Of late years, it has extended in other directions. As showing the difficulty in obtaining hybrids, from plants of different species, and the impossibility of obtaining species that shall continue fertile each with the other, Dr. Hooker, in discussing the relations and distribution of species of plants, lays down the following propositions as axioms: 1. That all the individuals of a species have proceeded from one parent (or pair) and that they retain their distinctive (specific) characters. 2. That species vary more than is generally admitted to be the case. 3. That they are also much more widely distributed than is usually supposed. 4. That their distribution has been effected by natural causes; but that these are not necessarily the same as those to which they are now exposed. Hybridization has been supposed by many to be an important element in confusing and making species. Nature, however, seems effectually to have guarded against its extensive operation and its effects in a natural state, and, as a general rule, the genera most easily hybridized in gardens are not those in which the species present the greatest difficulties. With regard to the facility with which hybrids are produced, the prevalent ideas on the subject are extremely erroneous. Gärtner, the most recent and careful experimenter, who appears to have pursued his inquiries in a truly philosophical spirit, says that 10,000 experiments upon 700 species produced only 250 true hybrids. It would have been most interesting had he added how many of these produced seed, and how many of the latter were fertile, and for how many generations they were propagated. The most satisfactory proof we can adduce of hybridization being powerless as an agent in producing species, (however much it may combine them,) are the facts that no hybrid has ever afforded a character foreign to that of its parents, and that hybrids are generally constitutionally weak and almost invariably barren. Unisexual trees must offer many facilities for the natural production of hybrids, which, nevertheless, have never been proved to occur, nor are such trees more variable than hermaphrodite ones. The following will show some of the principal facts connected with hybridizing plants, taken from the work of George William Johnson, of England, on Gardening. The seed vessel is not altered in appearance by impregnation from another plant; therefore, no hasty conclusion of failure is justified by that want of change. The color of the future seed, not of that first hybridized, seems to be most influenced by the male plant, if its seeds and flowers are darker than those of the female. Mr. Knight found, that when the pollen of a colored-blossomed pea was introduced into a white one, the whole of the future seeds were colored. But when the pollen of a white blossom was introduced to the stigma of a colored blossom, the whole of the future seeds were not white. Capt. Thurtell, from his experiments on the pelargonium, also informs me, that he has always found the color and spot of the petals to be more influenced by the male than by the female parent. Indeed, all experience proves that the progeny usually, though not invariably, most resembles, in color, the male parent. Large stature and robustness are transmitted to the offspring by either parent. It does not absolutely matter for obtaining this characteristic, whether it be the male or female which is large; but Mr. Knight generally found the most robust female parent produced the finest offspring. Capt. Thurtell, from lengthened observation and experiment, has ascertained that the form of the petals follows most closely that of the female parent. Mr. Knight says that the largest seed from the finest fruit that has ripened earliest and most perfectly, should always be selected. In stone-fruit if two kernels are in one stone, these give birth to inferior plants. The most successful mode of obtaining good and very distinct varieties, is to employ the pollen from a male in a flower grown on another plant than that bearing the female parent. To avoid previous and undesired impregnation, the anthers in the female parent, if they are produced in the same flower with the pistils, must be removed by a sharp-pointed pair of scissors; and the flower inclosed in a gauze bag, to exclude insects, until the desired pollen is ripe. Another effectual mode of avoiding undesired impregnation, is bringing the female parent into flower a little earlier than its congeners, and removing the anthers as above described; the stigma will remain a long time vigorous if unimpregnated. Although the fertility of all the seed in one seed vessel may be secured by applying pollen only to one style, even where there are several, yet the quantity of pollen is by no means a matter of indifference. Koelreuter found, that from fifty to sixty globules of pollen were required to complete the impregnation of one flower of *Hybiscus Syriacus* but in *Mirabilis jalapa*, and *M. longiflora*, two or three globules were enough; and in the case of pelargoniums, Capt. Thurtell says two or three globules are certainly sufficient. M. Haquin, a distinguished horticulturist at Liege, has impregnated flowers of the azalea with pollen kept six weeks; and camellias with pollen kept sixty-five days. He gathers the stamens just previously to the anthers opening, wraps them in writing-paper, places them in a warm room for a day, collects the pollen they emit, and preserves it in sheet lead in a cool, dry place. M. Godefroy suggests, that two concave glasses, like those employed for vaccine virus, would be better. The globules of the pollen must not be crushed. M. Haquin thinks the pollen of one year will be effective, if preserved until the year following. Mr. Jackson, of Cross Lanes Nursery, near Bedale, says, he has found the pollen of the *Rhododendron Smithii tigrinum* retain its fertilizing power even for twelve months. It is easy to discern whether impregnation has been effected, as in such case the stigmas soon wither. The stigmas which have not received the pollen remain for a long time green and vigorous. Whenever double flowers may be desired, if a double flower should chance to have a fertile anther or two, these should be employed for fertilization, as their offspring are almost sure to be very double. Superfœtation has been doubted; but as it occurs in the dog, we see no reason for disbelieving its possibility in plants. Capt. Thurtell thinks it may be done by the bee introducing mingled pollens at the same instant. Then why not if a similar mixture is inserted by the camel's-hair pencil of the cultivator? Plants nearly related, that is, closely similar in the structure of their varions parts, are those only which will immediately impregnate each other; but it is impossible, at present, to say what families of plants may or may not be brought into fertile union through intermediate crosses. A very short time ago, the azalea and rhododendron were thought incapable of such union, but this opinion is now exploded, for *rhododendron ponticum* has been fertilized with the pollen of *azalea sinensis* and the progeny between the first, an evergreen, and the latter, a deciduous shrub, is the previously unknown phenomenon, a yellow rhododendron. In cross-fertilization and hybridizing, suitable male and female plants are to be selected, and which blossom at the same time. The plant to be impregnated is to be carefully divested of its stamens, if it have any, and the pollen from the male plant dusted upon the female organ. The flower is then to be isolated from any possible contact with the pollen of other plants, and the seed taken, when ripe, carefully labeled, saved, and at the proper time sown. To return to animals. Wilson observes that every mule is a compound of two species, and seems to be, to a certain extent, a malformation of each, and a type of neither; and while unable to reproduce the specific form of his dam, or of his sire, he is wanting in a sufficient specific character of his own to be the proper subject of reproduction. Nor do mules exhibit a true blending of the specific properties of their parents; but as regards the most important properties, such as size, form, constitution, temper, and habits, they generally possess a closer resemblance to their dam than to their sire. Buffon says, in the case both of mules and hinnies, that they retain more of the dam than of the sire, not only in magnitude, but in the figure of the body; whereas in the form of the head, limbs, and tail they bear a greater resemblance to the sire. The same naturalist infers, from various experiments respecting cross-breeds between the he goat and ewe, the dog and the wolf, the canary bird and the goldfinch, that the male transmits his sex to the greatest number, and that the preponderance of males over females exceeds that which prevails where the parents are of the same species. Any two species of the equine genus will hybridize with each other, but some do so with facility and willingness, and others with difficulty and repugnance. Mules have been generated between the horse and the quagga. They are readily produced between the horse and the ass, as is well known; but they are very reluctantly and sparingly produced between the ass and the quagga. In an experiment related by Pennant, a he ass and a she zebra were for some time unsuccessfully kept together with a view of their hybridizing; but after the ass was taken aside and painted in such a manner as to resemble a zebra, and conducted back to his companion, they united and produced a mule; another ass and zebra mule was produced at Turin, but it died as soon as it was born; and another, a well-formed female mule, was produced in a menagerie at Paris, from a Spanish ass of the largest size, and a female zebra, and became larger than its dam, acquiring a form somewhat similar to that of its sire, and was remarkable for docility. In another experiment a female zebra was covered by a stallion and became pregnant, but died in the eighth month of her gestation, and when her body was opened the fœtus was found to be a male without hair, and marked on the head with black and white stripes. The same authority, after referring to the similarity of the name in different languages of the true mule, produced by the jack crossed upon the mare, tells us that the mule has considerably more resemblance to the horse than to the ass, and often, in the south of Europe, is a very fine animal of from fifteen to seventeen hands high. Its head has generally a clumsy form and a heavy appearance, and is the most exceptional part of the whole system. These animals are considered by naturalists to be distinct, but nearly allied, species. According to the latest authorities they are members of two genera, though formerly the horse and the ass were both included under one. The scientific name of the horse is *Equus caballus;* of the donkey, *Asinus vulgaris;* and the zebra, or quagga, is called *Asinus zebra* by Baird. In every country the mule is sure-footed and hardy. In Spain it has the finest form and appearance; in Savoy it has a remarkably large size; in Egypt it is about equal in value to a medium horse; and in the mountain regions of large portions of both Europe and South America it is far more serviceable than the horse could be, and completely supersedes the horse for packing, and often even for the saddle.

HYDATID. A race of entozoic animals resembling a small bladder, and infesting the liver, brain, uterus, and other parts of mammals. (See Sheep.)

HYDRACIDS. Acids containing hydrogen, as muriatic acid, etc.

HYDRAGOGUE. Violent cathartics, which cause an expulsion of much fluid.

HYDRANGEA. A highly ornamental class of plants, deciduous shrubs, not hardy in the northern portion of the United States, but requiring protection from frost during winter. The best plan for saving the plants over winter is to take them up with plenty of earth about the roots, and placing them in pits covered with glass, giving a little air in mild weather, and keeping them pretty dry. South of 40° they may be sheltered with straw where they grow. The whole genus are very impatient of drought and sun. Hence it is usual to plant them where they may have a moist atmosphere and shade. One of the most beautiful species is Hydrangea Otaksa. *H. Hortensis* is the variety usually cultivated. The principal point in the cultivation of Hydrangeas is to give them plenty of water during summer and to thoroughly ripen the wood for winter. It has been recommended to form a basin of clay all around the plants, eight or ten inches underground, and in dry weather keep this thoroughly saturated.

HYDRATES. Compounds in which water combines, as an acid in its equivalent of nine, as hydrate of lime, or water slacked lime.

HYDRAULICS. The science which treats of the movement and mechanical effects of water and liquids.

HYDRO. A chemical prefix, indicating the presence of hydrogen; as hydrochloric, hydrobromic, hydrocarbon, and hydriodic.

HYDROCARBONS. A general term for the oily, waxy, and resinous products of vegetation, which are rich in hydrogen, and often contain hydrogen and carbon only.

HYDROCELE. A collection of water in the scrotum.

HYDROCHLORATES. An old term for chlorides.

HYDROCYANIC ACID. Prussic acid, a pellucid fluid, of strong odor, one of the deadliest poisons known. Ammonia is the best antidote.

HYDRODYNAMICS. The science which shows the methods of applying the properties of fluids to mechanical purposes.

HYDROFLUORIC ACID. A pungent, gaseous acid formed of one equivalent, fluorine, and one hydrogen.

HYDROGEN. A natural element, one of the constituents of water which is always formed when hydrogen gas is burned in combination with atmospheric air, or with oxygen gas. It is known to us, in its simplest form, only in the state of gas, and is speedily fatal to animal life when it is breathed unmixed with atmospheric air. It is, however, a component of animal matters, and it forms a very essential part in the economy of vegetable substances, in which it is always found. Thus sugar contains 6.90 per cent. of hydrogen; gum 6.93; beeswax, 12.672; wood of the oak, 5.69; wheat starch, 6.77; acetic acid (the acid of vinegar), 6.35 per cent. It is the lightest of all ponderable matter, 100 cubic inches weighing only 2.15 grains. No known degree of cold has been able to condense it to a liquid. It can not support combustion, but is combustible in conjunction with atmospheric air. It constitutes one-ninth of the weight of water. Most vegetable structures contain hydrogen in the form of water, but the hydrogen essential to this constitution can not exist in the form of water. That hydrogen gas exerts a considerable influence upon the leaves of plants, was first noticed by Dr. Priestley. Sennebier found that plants which lose their green color in the dark, preserve it under those circumstances, if a small portion of hydrogen gas is present in the atmosphere in which they are placed; and Dr. Ingenhous noticed that its presence, when they are growing in the light, renders their color of a deeper green. Humboldt has noticed that plants growing in the galleries of the coal mines, preserve their green color, although vegetating in the dark, and that, in such situations, the atmosphere contains a proportion of hydrogen gas.

HYDROMETER. An instrument for measuring or determining the specific gravities of liquids, and thence the strength of solutions, spirits, and all substances of which water forms the principal part.

HYDROPHILIDÆ. Aquatic, pentamerous beetles; vegetable feeders.

HYDROPHOBIA. This dreadful disease, which seldom appears in domestic animals, and then only communicated by the bite of a canine animal, appears in the horse in from fifteen days upwards; in cattle, in from twenty to thirty days; in sheep and swine, from about the twentieth day after being bitten. An attempt to swallow liquid will bring on spasms of the throat, which throws the animal into convulsions. The animal trembles and staggers, the eye is wild, and, at last becoming frantic and mad, it dies. The disease is always fatal, and hence it is useless to attempt a cure. If hydrophobia is suspected, place the animal in a secure place where it can not harm any one, and as soon as the symptoms are those of pronounced hydrophobia, kill it at once and bury deeply.

HYDROSTATIC BALANCE. Balance furnished with a scale for determining the weight of any substance to be weighed in water.

HYDROSTATICS. The science which explains the mechanical properties of fluids.

HYDROSULPHURIC ACID. Sulphuretted hydrogen. Hydrosulphurets are the sulphurets or sulphides of metals and bases.

HYGIENE. The arts necessary to the preservation of health.

HYGROMETER. An instrument which indicates the degree of moisture or vapor present in the atmosphere, or its relative degrees of dampness and dryness.

HYGROMETRIC, HYGROSCOPIC. Having the quality of absorbing moisture during wet, and partially losing it in dry weather.

HYLOBIUS. A genus of tetramerous beetles, resembling the curculios, and infesting trees.

HYMENIUM. The gills or porous membranes in which the pores of fungi are placed.

HYMENOPTERA. An order of mandibulate insects, comprehending those which have four membranons wings with few nervures.

HYPERTROPHY. An unusual increase in size of any organ of the body.

HYPOCHONDRIUM. The region of the body under the cartilages of the false ribs. The liver lies in the right, and the spleen in the left hypochondrium.

HYPOCRATERIFORM. Salver-shaped. A corolla consisting almost entirely of a tube.

HYPODERMIC SYRINGE. A small syringe with a needle point, pierced with a delicate canal, for injecting medicated liquids under the skin, directly into the circulation. In operating it is used to allay violent pain, and for prompt and energetic action, and of late years has proved valuable with animals as for a long time with the human family. Shave the hair from the part to be operated upon, pinch up the skin, make a slight cut in the edge of the ridge, insert the point of the syringe, the full length under the skin, in the loose tissue, withdraw it half way and inject the contents. It should be used under the advice of a veterinarian.

HYPOGASTRIUM. The portion of the abdomen reaching from the lowest parts to near the navel

HYPOGYNOUS. Stamens, or other organs, attached below the base of the ovarium.

HYPOPHYLLUM. A partial leaf, clasping the stem, and without lamina.

HYPOTHESIS. A speculation not based on facts, but explaining certain phenomena.

HYSSOP. *Hyssopus officinalis.* A perennial rooted labiate plant, of aromatic and bitter properties.

HYSTERIA. A nervous complaint, attended with convulsions and peculiar flatulency. (See Blackwater in Horses.)

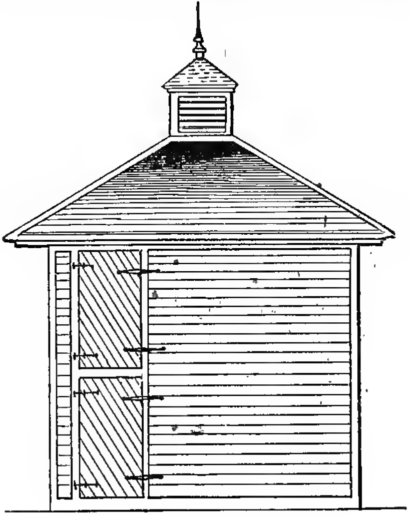
HYSTRICIDÆ. The family of *Rodentia,* to which the porcupine belongs.

I

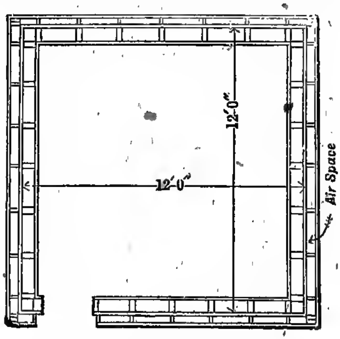
ICE. Water congeals at and below 32° Fahrenheit, and expands one-ninth of its volume at 40° Fahrenheit; hence when freezing occurs in the pores of rocks, the earth, etc., it often produces disruption of the particles. It is this action that mellows lands ploughed in the fall.

ICE HARVESTING. In harvesting ice the proper tools should be purchased. These are, a marker for marking lines, an ice plow for deepening the furrows; ice chisels and bars for separating the cakes; ice picks, an ice saw, and two sets of grappling hooks. One set of tools will be sufficient in cutting ice for a whole neighborhood, so that by coöperation the cost will be light to each individual. The ice is first marked with the marker into straight lines one way, a boy leading a horse to a line, thereafter the gauge will keep the whole straight. Turning, then mark across, thus dividing your fields into squares. Then deepen the grooves, more or less, according to the thickness of the ice, when the whole field may be divided into strips with the bar, floated to where it is wanted and then easily broken into perfectly square cakes. Pack these carefully in layers in the house, and as high as the plates. Cover with a foot of coarse sawdust, or eighteen inches of slough hay, and close the house tight, leaving only ventilation above the covering at the peak. If no proper tools can be had, ice can be cut with tolerable accuracy by stretching a line and marking it with an ice-pick or pike-pole. So proceed over the field, making your lines regular and twenty inches apart; with the saw, cut into strips, and again into squares, when these may be drawn out by means of a board a foot wide, having pins at one end for holding the ice when the board is thrust under it. Few farmers realize the importance of a supply of ice during the summer. It will fully repay the interest on the cost of the house and implements, and the labor of hauling, even for a considerable distance. (See Ice.)

ICE HOUSE. Near all situations where a supply of ice may be had in winter, an ice house will be found one of the best paying investments that can be made. From it, in summer, the water carried into the field for drinking may be cooled, meat and other food may be kept fresh and sweet, indefinitely, and it will be found useful in many ways especially in case of sickness in the family. In dairying ice is absolutely indispensable. Many farmers are deterred from erecting an ice house from want of accurate knowledge how they should be built. The plan we give will hold from thirty to thirty-five tons of ice, is cheap and as good, so far, at least, as saving ice is concerned, as the best, and, if necessary, will preserve ice two years.

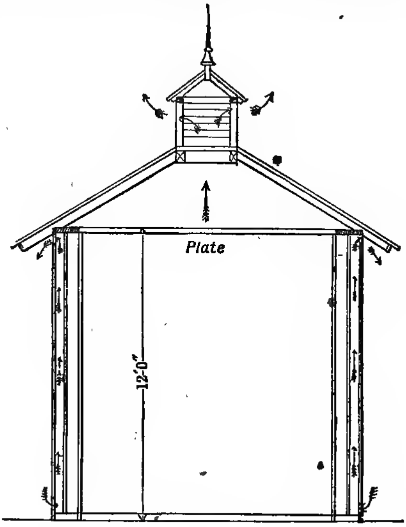


ICE HOUSE.



GROUND PLAN.

The house should be built upon a dry foundation where the drainage is perfect. If the soil is not sufficiently porous to allow water to pass off freely drainage should be provided by means of tile or a foot of rock, gravel, etc., should be laid down with a drain leading away from it. The specifications are as follows: Sills to be 2 by 12, bedded level on the ground, the inner studs, 2 by 6, sheathed on both sides with common boards, the outside to be covered with felt paper, the space formed by sheathing to be filled with tan bark or saw dust. The outer studding to be 2 by 4, spiked to outside of sheathing and covered with common siding, leaving a space under frieze and above base of three inches. The floor to be constructed by spreading from four to six inches of tan bark or saw-dust, level the same and cover with common boards, leaving a three-quarter inch space between each. The plates to be the same as studs, 2 by 12, rafters, 2 by 4, roof shingled. Ventilators in top should be 2 ft. 6 in. square. Doors doubled and filled with saw dust. Below we give the full bill of lumber: 8 pieces, 2 by 12 by 14, for sills and plates; 30 pieces, 2 by 6 by 12, for inner studs; 5 pieces, 2 by 6 by 12, for hip rafters and collar beams; 38 pieces, 2 by 4 by 12, for outer studs; 20 pieces, 2 by 4 by 12, for rafters and the ventilator; 750 ft. siding, 14 ft. long; 2,000 ft. common boards, for sheathing, floor, roof, etc.; 24 pieces fencing, surfaced, 12 ft. long, for corner boards, etc.; 80 yds. building paper; 3,000 common shingles.



ELEVATION.

ICHNEUMON FLIES. Small hymenopterous insects, which lay eggs in the bodies of aphides, caterpillars, and other insects, and even in the eggs of these; the young eat and destroy the creatures in which the egg is deposited.

ICHOR. A thin, purulent, and acrid discharge.

ICOSANDRIA, ICOSANDROUS. Flowers with twenty stamens.

ICTERUS. Jaundice; hence *icteroid*, yellowish, like the color of the skin in jaundice.

IDIOPATHIC. Independent of other diseases.

IDIOSYNCRASY. A peculiarity of constitution.

IGNITION. Combustion, burning.

ILEUM. The lower portion of the small intestines.

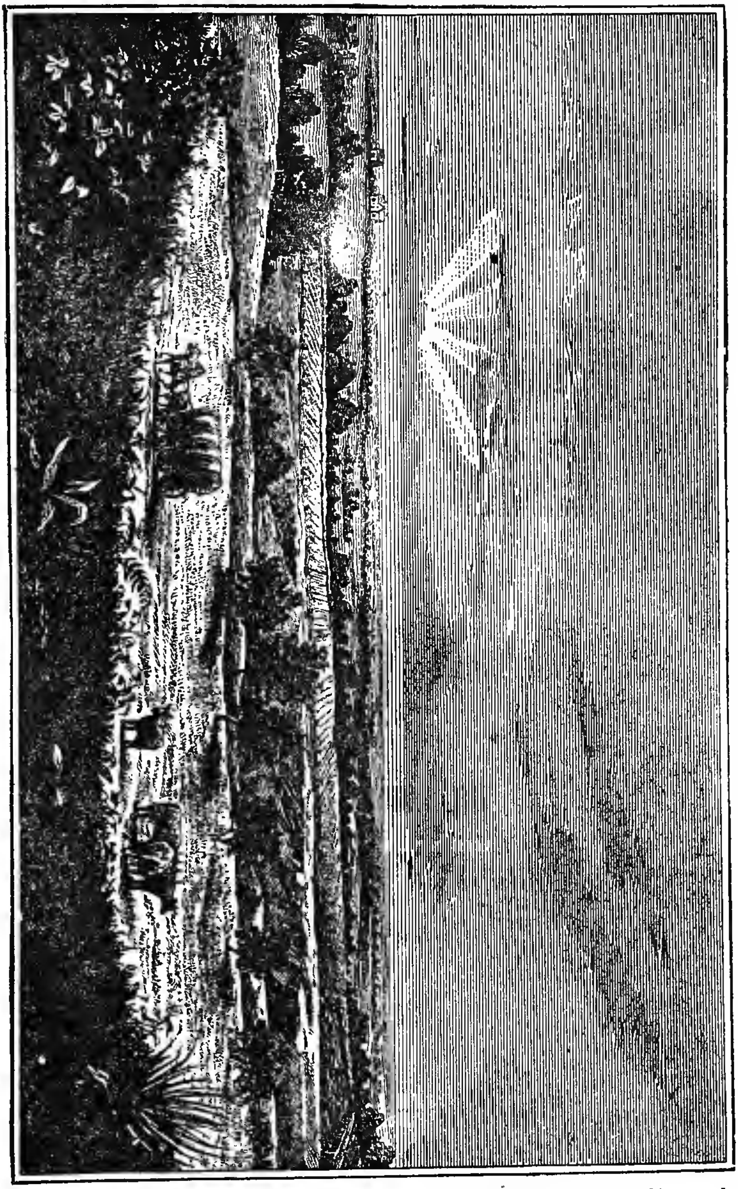
ILEX. (See Holly.)

ILIA. The lower sides of the abdomen; hence *iliac, iliacus*, related to the ilium.

ILIUM. The haunch bone.

IMAGO. The winged insect.

IMBRICATED. Overlapping, like the shingles of a roof.



IMMIGRATION INTO THE FAR WEST.

IMMIGRATION. The history of Immigration, into the United States, furnishes a most curious study, as showing to how many nations of the earth we are indebted for our wonderful growth and prosperity. In the West, the influx has been most constant and marked, and has exercised a commanding influence in the tastes and habits of communities. In this the Germans and their descendants, and the Irish and their descendants predominate with this difference: The Irish element is chiefly found in and about our cities, while the German element is distributed in both cities and country. As agriculturists, they form the bulk of our emigrant population in the country. Honest, laborious, quickly acquiring property, their families soon become Americanized. Since the late war, and especially within the last three years, the influx has been immense, and since the emigrants from the Continent of Europe, and in fact all the emigrants, except comparatively few, bring with them respectable sums of money, they not only add to the productive industry of the country, but add also to its immediate wealth. Prior to 1820, the number of emigrants arriving in the United States is stated at 250,000; from 1820 to 1830, the number arriving was 151,824; from 1831 to 1840, 599,125; from 1841 to 1850, 1,713,251; from 1851 to 1860, 2,598,214; from 1861 to 1870, 2,491,451, making an aggregate of 7,803,856. Of this the total from Great Britain was 3,857,850; 2,700,493 of this number being from Ireland. Germany contributed, 2,276,500; Prussia, 100,983; Sweden and Norway, 153,928; France, 245,812; other European countries ranging from 61,572, in the case of Switzerland, to 4,695 for Portugal. Again, from 1868 to 1875, the emigrants arriving in the United States, were, 2,531,596. Of these Great Britain sent nearly four-tenths, and Germany nearly as many. The entire world made contributions to our population but except the Teutonic nations, Great Britain and France, they constitute but a small fraction of the emigration. It will readily be seen, therefore that the genius of our civilization remains English and German, than which, there is no higher on the face of the earth. The influx of population to the United States, and the hegira across the country to the West, constitutes the wonder of modern times. The greatest wonder being that peoples of every nation, and of so many varying tastes, should settle down together and live in quiet and harmony, and without jarring discord. Its effect on Western production has also been wonderful. In 1850, only five per cent. of the wheat crop of the country was produced west of the Mississippi. In 1876, forty per cent. of the wheat crop of the country was raised west of the Mississippi. In 1878, the wheat crop of the United States reached 420,122,400 bushels. Of this amount, 194,046,960 bushels were raised in the States west of the Mississippi. In the same year, 1,388,218,750 bushels of corn were raised in the United States. Of this 510,836,800 bushels were raised west of the Mississippi. Without this material emigration from the enlightened countries of Europe, the West to-day would be fully twenty years behind its present development.

THE OLD.

THE NEW.

IMPACT. The concussions of one body on another.

IMPACTION OF THE STOMACH. (See Blown; also Gastritis.)

IMPENETRABILITY. An essential property of matters, whereby one molecule only can occupy a given space at a certain time.

IMPERMEABLE. In physics, means capable of resisting the passage of gases as well as fluids.

IMPETUS. The force or momentum of a body in motion.

IMPHEE. (See Sorghum.)

IMPLEMENTS, FARM. (See Plows, Stirring the Soil, etc.)

IMPONDERABLE. A term used to express light, heat, or electricity, which are destitute of any discoverable weight.

IMPOSTHUME. An abscess.

IMPOTENCE. The breeding of animals has, in many cases, been carried to such a high degree of fineness, and close inter-breeding is so much practiced, that impotence is not now an unusual occurrence among the higher caste of the finer breeds. In many cases, however, this is not so much the result of degeneration as from precocity in accumulating fat, and is especially noticed in females, and then again from being unduly forced with feed while yet young. The feeder's profit lies in fattening animals as young as possible. It is not unusual to see Short-horns made fat and ripe for beef at from eighteen months of age to that of two years, and, at three years past, just the age that cattle should begin to be useful as breeders, steers and heifers, are found in our markets fully matured as heavy weights in beef. It is true they are occasionally fattened to immense weights, between three and six years of age, but herein lies no profit to the feeder. Another prolific cause of impotency would seem to be the mania, that raged some years since, to increase the size of animals by selection, coupled with high feeding. Here, two causes worked against fertility. They were kept constantly fat; and this, in connection with the selection of immense animals, as breeders, led to deficient vigor; so it was not unusual to find a bull at five or six years old—just when he should be in his prime—past value as a stock getter. The feeding of animals in such a way as to develop excellence in the best degree, does not mean fattening. They should have food sufficient, and of variety sufficient, to give full vigor without unduly loading with fat. It is true high feeding and warmth will produce wonderful animals to look at. So will high cultivation, watering, and hot-house forcing do the same with plants, but they are deficient in constitution, and unproductive in seed. The best breeders have found out this fact, long known to gardeners and hence of late years, while breeding animals have been liberally fed, they have not been denied due exercise. And the causes of impotency having been removed, the disability has disappeared.

IMPREGNATION Conception. In horticulture, the contact of pollen with the stigma is called impregnation; without this, no seed is produced. Artificial impregnation is hybridizing.

INANITION. A state of languor, emptiness.

INARCHING. A system of grafting by the wood of young, vigorous trees, planted near an old one, so the inner bark of each will meet.

INDIAN CORN.—Rank and yield of the State, with average annual product for nine years.

Rank.	States.	Total value of Crop.	Value per Acre.	No. of Acres.	Amount of Crop. Bush.	Yield per Acre. Bush.
1	Illinois	$70,749,941	$ 8.97	7,879,399	224.499,337	28.60
2	Ohio	40,446,413	14.49	2,824,603	99,690,587	35.40
3	Iowa	36,380,133	8.61	4,229,245	142,731,825	33.90
4	Indiana	34,569,018	11.12	3,152,729	98,897,188	31.40
5	Missouri	30,833,242	9.31	3.359,361	98,892,225	29.10
6	Pennsylvania	23,834,112	20.57	1,167,767	41,581,875	35.50
7	Kentucky	22,617,735	11.65	1,958,169	58,019,637	29.70
8	Texas	22,323,275	13.62	1,728,992	36,910,875	21.40
9	Tennessee	20,563,298	10.20	2,024,475	46,586,900	22.90
10	Kansas	20,092,798	8.36	2,434,666	88,254,950	36.70
11	Georgia	17,335,767	8.32	2,098,474	22,928,800	10.90
12	Alabama	16,552,957	9.61	1,783,910	23,490,163	13.40
13	Mississippi	15,261,916	11.41	1,354,883	20,892,050	15.40
14	New York	13,793,881	21.09	627,128	20,613 000	32.90
15	North Carolina	13,386,316	8.72	1,550,549	22,960,587	14.80
16	Arkansas	10,941,075	13.61	818,140	18,933,350	23.20
17	Virginia	10,207,061	10.38	989,294	19,503,950	19.70
18	Michigan	10,194,313	15.72	648,543	21.454,525	32.70
19	Wisconsin	10,052,874	13.34	775,082	25,086,575	31.90
20	Nebraska	8,901,748	7.57	1,169,389	45,170,350	37.75
21	South Carolina	8,563,595	8.03	1,107,069	10,269,875	9.40
22	Louisiana	8,436,503	13.21	656,404	11,151,338	16.90
23	Maryland	6,815,424	14.33	475,890	12,219,442	25.50
24	New Jersey	5,998,519	22.14	270,777	9,942,775	36.70
25	West Virginia	5,108 314	14.27	359,589	10,112,250	28.10
26	Minnesota	3,741,938	11.92	324.314	10,435,862	31.80
27	Florida	2,062,899	9.44	221,082	2,239,206	10.00
28	Delaware	1,944,580	12.38	158,937	3,689,625	23.30
29	California	1,650,221	30.73	58,088	1,936,031	34.00
30	Connecticut	1,588,395	23.51	62,373	1,867,437	30.00
31	Vermont	1,546,467	30.51	51,731	1,925,512	37.20
32	New Hampshire	1,437.503	32.90	45,851	1,757,925	38.30
33	Massachusetts	1,155.302	28.91	39,396	1,375 500	34.90
34	Maine	1,140,241	26.47	43,324	1.378,250	31.20
35	Rhode Island	246,915	25.91	9,434	282,325	29 10
36	Oregon	102,963	25.95	3,923	116,237	29.50
37	Nevada	17,830	40.06	459	13,600	29.00

They are bound together until union takes place. This is sometimes done to form a curious object, but is of no practical benefit, except in the case of a rare tree or fruit, which it is desirable to save.

INCANDESCENCE. A luminous heat.

INCANOUS. Hoary; covered with a whitish down.

INCH. The twelfth part of a foot.

INCIDENT. The meeting of one body with another. The angle of incidence is formed by the direction of the light to a line perpendicular to the plane of the surface on which it falls.

INCINERATION. Burning to ashes.

INCISIONS IN TREES. Drawing a sharp knife through the bark, down to the new wood of plum, cherry, and other trees, is often very serviceable when they are bark-bound. It should be done in summer, and the incision made from the branches to the earth.

INCISORS. The sharp cutting or nipping teeth placed in front in the jaws of animals.

INCOMBUSTIBLE. Not capable of burning. Cloths and wood are rendered almost incombustible by soaking in a solution of borax, alum, sal ammoniac, phosphate of soda, etc. The metallic salts used in preserving timber render it incombustible; it smoulders, but does not burn with flame.

INCOMPATIBLES. Substances which can not exist in solution without decomposition.

INCUBATION. The brooding of eggs until hatched, is called incubation. When performed by the mother fowl which laid the eggs, or by another fowl, it is natural incubation. Artificial incubation, a term now applied to the hatching of eggs by artificial heat, has long been practiced in Egypt, and some other Oriental countries, and is now extensively applied, in all civilized countries, in the hatching of chickens. The successful hatching of eggs, either by artificial or natural heat, requires good judgment and careful attention to secure good results. In hatching chickens by the mother hen, she should always have a place by herself, separate and apart from all others, and where she will not be likely to be disturbed. The nest should be about fifteen inches square for a large fowl, and if the eggs are to be hatched early in the season, the nest should have well broken, soft straw for the bottom, and this covered with feathers. After the first of May, in the North, the bottom of the nest should be placed on an inverted sod, properly hollowed, upon which is placed soft, short straw. The nest should be secluded, and it is better that it have a covered yard attached, containing food, water, and a dust bath. No hen should be allowed more eggs than she can completely cover. Early in the season from seven to nine eggs will be all that can be kept uniformly warm. In warm weather a large hen will cover thirteen easily enough. Artificial eggs are sometimes given for a day or two with a young hen, or until she sits steadily. The hen should leave the nest every day for a short time that the eggs may receive air. Seven or eight days after the hen has commenced sitting, the eggs may be examined with an egg tester, or by standing in a rather dark place and holding them up in the partly closed hand against a strong light. The fertile eggs will have a cloudy appearance. Those not fertile should be discarded. In warm weather, or if the hen is sitting in a very dry place, it is a good plan to sprinkle the eggs lightly with tepid water once a day, during the last four days of incubation. Always set a hen in the evening, and never set one which will leave the nest when you come near, or even if you examine the eggs under her. If the nest becomes verminous, sprinkle sulphur through it, and also on the back of the hen. If a dust bath is allowed, and the nest be sprinkled with sulphur at the time it is made, but little trouble will be experienced with vermin. The food to be given during incubation should be sand, corn, and oats whole, and pure water. Artificial incubation is performed by means of a variety of machines patented, and also the provision for artificial mothers in raising the chicks, the most difficult part of the business. The Egyptian plan was to hatch them in ovens. In France the system of hatching by means of fermenting manure, is still practiced to some extent. Modern ingenuity has devised means to furnish the heat from the top, as is natural, the germ of the future chicken floating at the top of the yolk. A perfect incubator should furnish heat at the top, have means of quickly determining the degree of heat by means of thermometers, and be provided with artificial mothers This is simply a box so contrived as to furnish a retiring place of cotton-wool, down, or other soft substance, that may be kept at a uniform degree of heat, with an enclosed yard, provided with food and water, where the chickens may take exercise.

INCUMBENT. In botany, leaning against.

INDEHISCENT. In botany, a fruit which does not open when ripe, as succulent berries.

INDIAN PONY. The name Indian Pony is rather a vague term, by which to designate any particular race of Indian horses. Those formerly known in the New England States, along the chain of the great lakes, both on the Canadian and States shores, were, and so far as they now exist, undoubtedly the descendants of the earlier French horses, dwarfed by generations of semi-wild life, and hard fare; those of the South were undoubtedly the descendants of the earlier Spanish adventurers, which had escaped from confinement. Those of the Indians of the plains, and of Texas, are the descendants also of Spanish horses resembling quite closely the mustang. Certain it is, the Indian pony of the North does not show Spanish blood, while those of the South, as we saw them many years ago, do. The Indian pony of the plains, of all the breeds of Indian horses, shows the most strongly his Spanish origin. The Indian pony is, as a rule, rounder and shorter barreled than the Canadian, and seldom over thirteen hands high. The neck is short and thick; the mane thick, coarse and heavy; the forelock often almost concealing the eyes. The legs and hoofs are strong and like steel, being fully equal to the Shetland in this respect. They carry their heads high, are docile, intelligent, sure-footed and courageous in a journey to a remarkable degree. The Indian pony, however, must not be confounded with the better class of pony horses, called Canadian ponies. Wherever found, they are dwarfed descendants of once larger horses. The ponies of Western Canada, of the West and of the South-west, have evidently been imbued with the Spanish blood of the plains, but as we go east we see more and more of French blood in them. They are now, however, as a race, nearly extinct. Hence, the description given by Frank Forester, as he saw them when they were comparatively plenty in the country, will not be uninteresting: On my first visit to Canada, he says, I had an opportunity of seeing great herds of these ponies, running nearly wild on the rich meadow lands about the Grand river, belonging to the Mohawk Indians, who had a large reservation on that river, near the village of Brantford, which took its name, I believe, from the chief, who was a son of the famous Brant, Thayendanagea, of ante-revolutionary renown. These little animals, which I do not think any of them exceeded thirteen hands, had all the characteristics of the pure Canadians, and, except in size, were not to be distinguished from them. They had the same bold carriage, open countenance, abundant hair, almost resembling a lion's mane, the same general build, and above all, the same iron feet and legs. I hired a pair of these, I well remember, both stallions, and they took me in a light wagon, with a heavy driver and a hundred weight, or upwards, of baggage, over execrable roads, sixty miles a day, for ten days in succession, without exhibiting the slightest distress, and at the end of the journey were all ready to set out on the same trip again. I was new at the time in America, and was much surprised and interested by the performance of this gallant little pair of animals. They were perfectly matched, both in size and color, very dark brown, and twelve hands and a half in height; and where the road was hard and good, could spin along at nearly nine miles in the hour. They were very merry goers. It was their wonderful sure-footedness, sagacity, and docility, however, which most delighted me. They were driven without blinkers or bearing reins, and where, as was often the case, bridges seemed doubtful, the bottom of miry fords suspicious of quagmires, or the road otherwise dangerous, they would put down their heads to examine, try the difficulty with their feet, and, when satisfied, would get through or over places, which seemed utterly impracticable. Whence this pony breed of Canadians has arisen, I am unable to say; but I believe it to be almost entirely peculiar to the Indian tribes, wherefore I am inclined to think it may have been produced by the dwarfing process, which will arise from hardship and privation endured generation after generation, particularly by the young animals and the mares while heavy in foal. These animals had, I can say almost positively, no recent cross of the Spanish horse; but I have seen, since that time, ponies approaching nearly to the same type, which showed an evident cross of the mustang; and I have seen animals called mustangs, in which I was convinced that there was Canadian blood.

INDIAN BREAD. (See Acorn.)

INDIAN CORN. (See Maize.)

INDIAN CRESS. (See Cress.)

INDIAN TOBACCO. *Lobelia*

INDIAN TURNIP. *Arum triphyllum.* Wake-robin. A common marsh plant, the bulbous roots of which contain much starch, and are occasionally eaten, after being dried, but it is acrid when fresh.

INDIA RUBBER. Caoutchouc. The dried milky juice of the *Siphonia elastica*, and other euphorbiaceous trees. It is a compound of ninety carbon and ten hydrogen.

INDIGESTION. Indigestion in horses is of two principal forms, one caused by engorgement of the stomach, or from feeding musty hay and grain. In colts, it is often occasioned by teething, and in older horses from decayed or defective teeth. The remedy is obvious, attention to the food, examination of the teeth, lancing the gums, if needed, in young horses, and the removal of defective teeth in old horses. Indigestion from engorgement, may be removed by mild purges, assisted, if necessary, by injections. If allowed to go on, it often results in affections of the brain, sleepy staggers, stomach staggers, and even in fatal forms of apoplexy. When the indigestion is chronic, first examine the teeth, feed only on light nutritious diet, and never enough so the animal will gorge itself. Give a light physic of a pint of linseed oil, followed by a tonic, twice a day, of one-half ounce each of bicarbonate of soda, and of powdered gentian, and twenty grains of nux vomica. If the indigestion is acute from engorgement, to the pint of linseed oil add twenty to thirty drops of croton oil, to be given at a dose. Foment the belly by means of blankets wrung out of hot water, and assist the physic with injections of soap and water. Since the only way to relieve the overloaded stomach, in the horse, is by the intestines. If sleepy staggers come on, stimulants, whisky half-pint doses, warmed with ginger may be given.

INDICATION. The particular treatment indicated by the symptoms of a disease.

INDIGENOUS. Native plants are so-called.

INDIGO. *Indigofera.* A vegetable dye, embracing a large industry in the East and West Indies, and Central America, from whence the indigo of commerce is obtained. The varieties cultivated in Hindostan are principally *I. nerium tinctorium* and *I. tinctoria argentea.* In the West Indies and Central America the variety *I. anil* is mostly planted. In Georgia, and other Gulf States this variety has run wild. *Baptisia tinctoria* is also indigenous in the South. In the last century indigo was extensively cultivated in the South. In 1731, 100,000 pounds were exported from Charleston, S. C. This was yearly increased up to the time of the Revolutionary war the yearly export reached 107,660 pounds. In 1794, 1,550,880 pounds were exported from the United States. The introduction of the cotton gin, and the profits arising from the cultivation of cotton, is undoubtedly one of the prime causes of the decline of indigo-raising in the United States. Near Orangeburg, S. C., there are six indigo farms carried on. Indigo requires rich but sandy land. It sprouts annually from the roots, requiring to be sown but once in seven or eight years. With capital and careful management there is no doubt but that the cultivation of indigo might again be made a paying industry upon suitable lands in the Gulf States. In regard to the culture and manufacture of indigo in this country, Porcher, in his work on the Resources of Southern Fields and Forests, (1869,) says, that the soils best adapted are the rich, sandy loams, though it grows on most lands moderately well, provided they are not wet. The ground should be well broken, and kept light and free from grass by the plow. The nature of the manure exerts a great influence upon the quantity and quality of the coloring principles. Those substances which act as stimulants to vegetation, such as lime, poudrette, ashes, etc., favor the growth of the plant without injuring the coloring matter.

Where barn-yard manure has been largely used a crop of grain should first be raised on the land. The seed should be mixed with ashes or sand and sown in drills fourteen inches apart, four quarts of seeds to the acre. In the climate of middle Georgia the seed should be sown the 1st of April. When it first comes up it should have the grass picked out with the hand. When an inch or two high the grass between the rows should be cut out by the hoe or scraper and the soil loosened about the roots. These weedings are enough before the first cutting, which should commence as soon as the plant throws out the bloom. It is so easily injured by the sun after being cut that the operation should be commenced and end in the afternoon. After cutting with the reap hook it is put under the shed until it can be put in the vats. In Georgia, two cuttings yielded sixty pounds of indigo to an acre, provided the roots were not injured in the first cutting, which, at three acres to the hand, would be one hundred and eighty pounds. It is said that among the Arab cultivators in Egypt and Morocco the seed is sown only once in seven years, and that two crops a year are obtained. Among these people the process of manufacturing or extricating the coloring matter from the plant is given as follows: Three wooden vats are provided and so placed at different levels as that the contents of the first can be readily transferred to the second, and again from that to the third. The upper vessel is called the steeping vat, and in this the plants are loosely laid, in sufficient quantity to cover the bottom, and water poured over them to the depth of two or three inches. In about eighteen hours fermentation begins and the plants swell and give off large quantities of gas, which tinges the water with a lively green color. After all the coloring matter, or grain, as it is technically called, is extracted, the turbid liquor is drawn off into the second vat where it is violently agitated and beaten in order to separate the grain from the water. A great quantity of air-bubbles are driven off by this beating, and the color of the contents of the vat changes from green to deep blue. When the grain has subsided to the bottom of the vat the supernatant liquor is drawn off and the grain is discharged into the third vat, where a further subsidence and drawing off ensue, and the grain is next transferred to sacks and hung up to drain. It is then placed in wooden boxes and exposed to the air and sun until all the moisture is evaporated, when the process is completed and the indigo is packed in chests ready for shipment. In the great indigo-factories of Bengal some part of the drying is effected by the agency of fire. The following process of manufacturing indigo in small quantities for domestic use is given by the Southern Agriculturist: Cut the indigo when the under leaves begin to dry, and while the dew is on them in the morning; put them in a barrel and fill this with rain-water, and place weights on to keep it under water; when bubbles begin to form on the top and the water begins to look of a reddish color, it is soaked enough and must be taken out, taking care to wring and squeeze the leaves well, so as to obtain all the strength of the plant; it must then be churned (which may be done by means of a tolerably open basket with a handle to raise it up and down) until the liquid is quite in a foam. To ascertain whether it is done enough, take out a spoonful in a plate and put a small quantity of very strong lye to it. If it curdles, the indigo is churned enough, and you must proceed to break the liquor in the barrel in the same way, by putting in the lye (which must be as strong as possible) by small quantities, and continuing to churn until it is all sufficiently curdled; care must be taken not to put in too much lye, as that will spoil it. When it curdles freely with the lye, it must be sprinkled well over the top with oil, which immediately causes the foam to subside, after which it must stand till the indigo settles to the bottom of the barrel. This may be discovered by the appearance of the water, which must be let off gradually by boring holes, first near the top and afterward lower, as it continues to settle; when the water is all let off and nothing remains but the weed, take that and put it in a bag (flannel is the best) and hang it up to dry, afterward spreading it to dry on large dishes. Take care that none of the foam, which is the strength of the weed, escapes; but if it rises too high, sprinkle it with oil.

INDIGO BIRD. *Cyanospiza cyanea.* A summer bird at the North. The males are of an indigo blue. Their food is the seeds of weeds and small insects. They make their nests in low bushes, generally near the habitation of man. They lay four or five eggs, nearly pure white, and but one brood is reared in a season.

INDUCTION. The process of arriving at generalizations, or laws, by a judicious investigation of numerous facts. In electricity, it is the influence one electrified body exerts on another, whereby its nearest surface is made to exhibit a kind of electricity differing from that of the excited substance.

INDUMENTUM. The coating of feathers on birds.

INDUSIÆ. The cases of certain water insects; they are silicious, calcareous, or ferruginous.

INDUSIUM. The thin membrane covering the fruit of some ferns.

INDUSTRIAL EDUCATION. The subject of industrial education has been partially discussed under the head of Agricultural Colleges. The idea of industrial education, that is, such education as would best fit the student for grappling with the sciences which underlie mechanical operations and agriculture, has long been mooted in the United States. (See Agricultural Education). At length, through the efforts of Hon. Justin Morrill, of Vermont, the popular agitation took form in the Act of Congress endowing colleges in every State with public lands for teaching such branches as are related to agriculture and the mechanic arts, including military tactics. In Europe, the subject of industrial education has spent itself chiefly in the direction of agricultural colleges. In our own country where agriculture is the paramount industry far above any other, after the matter was fully considered, it was found impossible to pass a bill through Congress for agricultural colleges without tacking to it the other industries, and a loop hole was left, eagerly seized by the scholastics to so mould these institutions of learning that they would *per se* follow in the old scholastic grooves of learning. The people, however, were closely watching the progress of these schools, and the major part have been kept somewhtt near the lines they were intended to follow. In this respect, the Agricultural College of Michigan has held to the popular idea, as understood and advocated by the most advanced practical thinkers. Each year there is progress being made in bringing these schools nearer and nearer to institutions where agriculture and the mechanic arts, or rather the sciences, relating to them, shall become the paramount studies. Industrial schools have long been known in Europe and America. One of the sophistical reasons, given by those who sought to change the name of the Industrial University of Illinois into that of the State University, was that the term industrial was generally regarded as being something savoring of crime or pauperism. It is hardly to be supposed that a State would erect a great university upon which more than $1,000,000 has been spent, to give education to this class. To show that the term industrial is not so understood in Europe, the following from the American Encyclopædia will show that the term Industrial Schools is used to designate three classes of educational institutions. These are as follows: First. Scientific schools, such as the *école des arts et métiers* at Paris and Berlin, and the polytechnic schools of the same cities; the schools of metallurgy, manufacturing, mining, and the chemical arts, so numerous on the continent of Europe; schools of civil engineering, architecture, and agriculture. Their number is constantly increasing, but they have nowhere else attained so high a development or so thorough a course of instruction as in Prussia, Saxony, Bavaria, and the duchy of Nassau. It is owing to the chemical and mechanical skill, and the tact and taste in the arts of design, developed by these schools, that the continental nations of Europe have been able to maintain their supremacy in manufactures. The industrial school (*Gewerbschule*) at Chemnitz, in Saxony, one of the best of its class, in 1857 had sixteen professors and teachers, and 237 pupils. Some of these schools have a very large corps of professors, and courses of study usually occupying six or seven years. Second. Technical schools, in which, in connection generally with elementary instruction in the common branches of study, the pupils are taught some practical art, trade, or employment; such are the lace workers' schools in Belgium and Ireland, the free schools of the arts of design, the agricultural farm schools, the schools for teaching household duties to girls, and the schools for the industrial instruction established in New York. In France, Belgium, many of the German states, and Ireland, such schools are numerous. A great impulse has been given to industrial instruction by the establishment of industrial associations in various countries, particularly in Germany, where they have become very numerous since 1848. There is a third class of schools established for the training of pauper and vagrant children in the habits of industry, and their instruction in rudimentary studies in connection with employment in some simple art or trade, by which they may subsequently obtain a partial support. These schools, to which the name industrial school is also applied, are wholly charitable; the children are usually wholly or partially clothed by the school, and one meal a day, or sometimes two, furnished them. The first idea of such a school seems to have originated with a poor mason in Rome, Giovanni Borgi (1736-1802), who collected the vagrant boys of that city in his own house, taught them to work, had them instructed in the rudiments of learning, and when they were old enough apprenticed them to artisans. On the continent of Europe industrial as well as secular instruction is given in the Sunday schools, while in the United States religious instruction only is given on that day, and hence the American ragged children's Sunday schools are not, even sophistically, to be identified with industrial univerities. According to returns made to the General Government, in relation to the progress of Industrial Education, in thirty-six States there are now thirty-nine colleges which have received the congressional land-grant of July 2, 1862. There are also branch institutions in Georgia and Missouri. The following is a list of the industrial institutions of the United States which had accepted the endowment in lands from the United States in 1875. The first column shows the location of the institution, and the second the name of the institution which has received the grant:

Location.	Name.
Auburn, Ala..........	Agricultural and Mechanical College of Alabama.
Fayetteville, Ark.....	Arkansas Industrial University.
Berkeley, Cal.........	University of California.
New Haven, Conn....	Yale College — Sheffield Scientific School.
Newark, Del........	Delaware College.
Eau Gallie, Fla......	Florida State Agricultural College.
Athens, Ga......... Dahlonega, Ga....	University of Georgia.
Urbana, Ill...........	Illinois Industrial University.
La Fayette, Ind......	Purdue University—Indiana Agricultural College.
Ames, Iowa..........	Iowa State Agricultural College.
Manhattan, Kan. ..	Kansas State Agricultural College.
Lexington, Ky........	Kentucky University—Agricultural and Mechanical College.
New Orleans, La.....	Louisiana State Agricultural and Mechanical College.
Orono, Me............	Maine State College of Agriculture and the Mechanic Arts.
College Station, Md..	Maryland Agricultural College.
Boston, Mass	Massachusetts Institute of Technology.
Amherst, Mass.......	Massachusetts Agricultural College.
Lansing, Mich........	Michigan State Agricultural College.
Minneapolis, Minn...	University of Minnesota.
Oxford, Miss.........	University of Mississippi.
Rodney, Miss........	Alcorn University.
Columbia, Mo ..... Rolla, Mo..........	University of Missouri.
Lincoln, Neb.........	University of Nebraska.
Nevada	(No industrial institution established.)
Hanover, N. H........	Dartmouth College.
New Brunswick, N. J.	Rutgers College.
Ithaca, N.Y..........	Cornell University.
Chapel Hill, N. C	University of North Carolina.
Columbus, Ohio......	Ohio Agricultural and Mechanical College.
Corvallis, Ore.	Corvallis College.
Centre County, Pa....	Pennsylvania State College.
Providence, R. I......	Brown University.
Orangeburgh, S. C....	Claflin University.
Knoxville, Tenn......	East Tennessee University.
Bryan, Tex...........	Texas Agricultural and Mechanical College.
Burlington, Vt..	University of Vermont and State Agricultural College.
Blacksburgh, Va......	Virginia Agricultural and Mechanical College.
Hampton, Va	Hampton Normal and Agricultural Institute.
Morgantown, W.Va...	West Virginia University.
Madison, Wis.........	University of Wisconsin.

The professors and assistants in these colleges during the year numbered 473, and the students, 4,211. In 1876, eleven States had not sold all the scrip or land granted them by Congress.

Illinois, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, Nevada, New York, Oregon, and Wisconsin. They have sold during the year 51,405 acres, at an average price of $4.41 per acre, and 1,463,505 remain unsold. The largest average price obtained per acre by any State was $8.38, by Michigan, and the smallest, $2.20 by Iowa. In some of the colleges the number of students pursuing agricultural or mechanical studies is much smaller in proportion to the number in attendance than in others. This may be owing to several causes. In some cases the colleges have been recently established, and have not yet been brought into practical working order; in others the students were poorly prepared when they entered, in consequence of the low standard of education in the surrounding country, and in others, inducements were greater to enter upon other courses of study which seemed to promise more immediate profit; but these embarrassments are gradually becoming less, and when agriculture and the mechanic arts require higher qualifications for their practice and become more remunerative, they will, no doubt, entirely disappear. Some of the colleges have already attained a high standard of excellence, considering the time they have been in operation and the fact that they have largely to educate their own educators. A large number of students graduate at these colleges every year, and enter upon practical farming and the mechanic arts, or to become professors in industrial institutions of our own or other countries. The annual interest of all the institutions, except two or three, is given at $526,283, which, at six per cent. per annum, represents an investment of $8,771,383. The Commissioner of the General Land Office, in his annual report for 1869, states the aggregate claim upon the public domain accruing under the agricultural-college-scrip legislation at 9,510,000 acres, which, at the minimum price, $1.25 per acre, amounts to $11,987,500. But the prudence with which some institutions have husbanded their resources has raised the average much above this minimum. There yet remain 1,463,305 acres to be disposed of, which, at the highest average price obtained, will add about $6,500,000 to the fund. It will doubtless average much higher than this, and will probably raise the aggregate to $19,000,000 or $20,000,000.

INDUVIÆ. Organized remains; the withered leaves of monocotyledonous trees, etc.

INERMIS. Unarmed; without spines or prickles.

INERT VEGETABLE MATTER. Peat, tan, etc., which does not readily ferment; mixture with dung, lime, or ashes reduces it.

INERTIA. The indifference of matter to rest or motion.

INFLAMMATION. An unnatural increase of circulation, blood, and heat in any part. It originates in irritation, colds, contagion, and unhealthy conditions of the nervous system, and may attack any part. It begins with dryness, heat, pain, and tension, which is succeeded by increased vascularity, swelling, and secretion, and terminates naturally by resolution to the primary states, by the adhesion of parts or the formation of pus, ulceration, mortification, and death of the part. If the animal be vigorous, it is to be treated by bleeding, purging, blisters, and cooling applications. But the inflammations of weakly animals, especially when arising from contagion and ending in ulcerations and gangrene, is to be treated by stimulants and tonics, of which carbonate of ammonia (*sal volatile*) and bark are the best.

INFLAMMATION OF THE BOWELS. (See Enteritis.)

INFLAMMATION OF THE FOOT. (See Founder.)

INFLAMMATION OF THE LUNGS. (See Pleuro Pneumonia.)

INFLAMMATORY DISEASES. This is a class of diseases to which the horse, and also swine are peculiarly liable. The horse to inflammation of the brain and all the viscera, and the hog to inflammation of the lungs. In the horse the brain is often congested, resulting in inflammation showing itself in Phrenitis, mad or sleepy staggers. In the article Indigestion, staggers is noticed. In decided inflammation of the brain, from four to six quarts of blood should be drawn at once, and from the jugular vein, unless the pulse is feeble In all cases the bowels should be relieved by six drachms of aloes and one drachm of calomel, given as a ball, to be repeated the next day if the first do not act. Keep the animal quiet and in a dark place. The head should be kept cool with ice, or cold water, and if fever supervene, give several times a day, as a ball, one drachm of powdered digitalis, and two drachms of saltpetre. If paralysis shows itself, three grains of strychnine, given twice a day, cautiously increased from time to time, until twelve grains at a dose is reached, will be indicated. Inflammation of the viscera, heart, lungs, bowels, etc., must be met without strong purging. The object being to allay the inflammation and subsequent fever. Injections to relieve the bowels, and hot fomentations, and injections of morphia under the skin, fifteen grains, by means of a hypodermic syringe. In every case of inflammation of the lungs, brain, bowels, etc., a veterinarian should be called if possible.

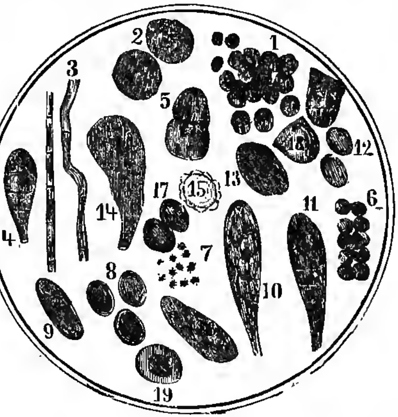
INFLATED. Distended like a full bladder, as the carpels of some plants.

INFLEXED. Bent inward.

INFLECTION. In optics, the same as diffraction.

INFLORESCENCE. The grouping of flowers on the stems of plants; the principal forms are the spike, raceme, corymb, umbel, panicle, thyrsus, catkin, capitulum.

INFLUENZA. Under the names Epizootic, Contagious Catarrhal-fever, Contagious Influenza, Pink-eye, etc., this disease has been known to veterinarians, and since the year 1872, generally to the horsemen of the United States and Canada. Its immediate cause is entirely unknown, but that it is produced by blood poisoning through germs floating in the air is now generally received as true. The first symptoms are general weakness, staggering gait, hanging head, trembling limbs, shivering, watery discharge from the nose, staring hair, and loss of appetite. The pulse is weak but quick, from fifty to sixty per minute, and from that up to eighty or ninety. The breathing is hurried, from forty to fifty inspirations a minute, and the temperature of the body over 100° even to 105°. The horse seems to be afraid to lie down, and so stands with propped legs, the bowels are bound up, and the urine scanty; the discharge from the nose becomes white, yellow or greenish, and death ensues from weakness and exhaustion, or from suffocation, paralysis, or from clots formed in the heart. Under the microscope the disease germs assume various forms. The figure shows some of them magnified 400 diameters. The treatment consists in good nursing, keeping the strength of the animal up by light, nutritious diet, and gruels, and in combating the symptoms as they appear under the many complications which this disease assumes. Dr. James Law, of Cornell University, in an elaborate monogram upon the disease, to the United States Government, gives the treatment to be followed, in various phases of the disease, even to the injection of pure blood into the veins of weakened animals. From it we excerpt that which will be of value to the farmer, in the treatment of the disease as it appears in malignant forms. All debilitating or depressing treatment must be sedulously avoided. Bleeding, purging, severe action on the kidneys, depressing sedatives and violent blistering, are alike to be deprecated. In the regular and uncomplicated form of the disease, nearly all will recover under good nursing and fresh air, and independently of all medicinal agents. Place the patient in a cool, dry, well-ventilated, and well-littered box; clothe him comfortably, so as to avoid all tendency to chill, bandage his legs loosely, and change the clothes, and curry or brush the skin twice or thrice a day; keep quiet and still, although usually a little exercise in hand, in the shelter and sunshine, will be rather beneficial than otherwise. Feed on bran mashes, boiled oats or barley, turnips, carrots, or other roots, in small quantities, and often, so as not to clog the appetite, and supply at frequent intervals a quart or two of water, nearly cold, or cold oatmeal, or linseed gruel. It is important to favor depuration of the blood by moderate but never excessive action of the kidneys or bowels. Costiveness will oftentimes be best met by abundant and frequent injections of water, blood warm, (three or four quarts at a time,) or by one-half pound of molasses, or three ounces of sulphate of soda added to the drink. If a laxative is absolutely necessary, it should rarely exceed one-third of the ordinary dose, on account of the dangerous susceptibility of the digestive organs. The author has seen a large Percheron die of superpurgation, after taking but three drachms of Cape aloes. During the recent visitation an instance came under his notice in which half a pint of linseed oil came nigh proving fatal. This susceptibility of the digestive organs, however, varies widely in different epizootics, and in some mild laxatives prove beneficial, yet their possible danger should be kept in mind. Mild febrifuge diuretics may be used with advantage. Spirits of nitrous ether, in half-ounce doses, may be given twice a day, or liquor of the acetate of ammonia, in ounce doses, four times a day in the water gruel drank. If the fever runs high, or effusions threaten to take place, these may be increased as far as the strength will allow, but always with the greatest caution and judgment. When the cough proves especially violent and painful, the addition of anodynes, such as belladonna and camphor, is advisable. A drachm of each may be added to the diuretics already advised. The cough may be further relieved, and the relaxation of the mucous membranes and the appearance of the discharge hastened, by causing the animal to inhale warm water vapor several times a day, for an hour at a time. This is most conveniently done by saturating chaff bran or other simple agent with boiling water, placing it in a nose-bag, which is then hung on the patient's nose by means of a strap crossing behind the ears. This proves especially beneficial, as the moderation of the fever is usually a concomitant of the appearance of the discharge. Burning a pinch of flowers of sulphur, more or less, according to the size and nature of the building, so as to impregnate the air to an extent just short of causing irritation and coughing, has a very soothing and beneficial effect on the mucous membrane. It is best done by laying a piece of paper bearing the sulphur on a shovel, and setting fire to it. It is superfluous, perhaps, to say that it must be done behind the patient, and not beneath his nose. The fumes of vinegar from a red-hot brick, of burning leather, and the like, are cruelly irritating, and occasionally induce fatal results. Counter-irritants are often useful from the first. If, however, inflammation and sore throat seem extreme, a poultice may be advantageously applied for a day previously, or the throat may be well fomented with warm water for an hour and then wrapped in a sheep skin with the wool turned inward. When, however, there appears little danger of even temporarily aggravating the local inflammation, the throat or chest, where the disease has been localized, it may be well rubbed with a thin pulp made of the best ground mustard and tepid water, and then covered up. This may be replaced by the soap liniment, made with six ounces of soap, three of camphor, and a pint, each, of proof-spirit, liquor ammonia, and linseed oil. This liniment may be applied repeatedly at short intervals and well rubbed in. If a more active blister is wanted an ointment may be used composed of a drachm and a half of powdered cantharides, a scruple of camphor, ten drops of spirits of wine, and an ounce of lard. The hair should be cut off and the ointment well rubbed in, in a direction contrary to that of the hair. After it has acted, the skin should be kept soft and pliant by rubbing it with fresh lard. Oil of turpentine, which has been largely used as a counter-irritant in a great number of cases, is only objectionable on the ground of its causing so much local irritation without blistering as to drive some excitable horses to distraction. In using any one of these



counter-irritants it is best to apply them over a limited space only, not exceeding the bounds of the inflammatory action, as we can thus secure the best results from the intimate nervous sympathy existing between the deeper-seated organ and the skin which covers the corresponding part of the surface, and at the same time avoid the depressing and debilitating effects of a blister. For this reason a careful examination, of the chest especially, should always be made before making such an application. As the mouth becomes cooler and more moist, and the pulse softer and less frequent, a more stimulating treatment is desirable. At first two drachms each of gentian, powdered cinchona, nitre and sal ammoniac, may be given night and morning, or if the debility is very great the last-named agent may be replaced by four drachms of carbonate of ammonia made into a bolus, with linseed meal, or dissolved in a half pint of water, and repeated three or four times a day. In cases marked by a daily remission, I have found a dose of thirty grains of sulphate of quinia to prove effectual in preventing the paroxysm, if given an hour or two before the period when it was in the habit of appearing. During convalescence gentian, cinchona, and other tonics, are desirable, with alcoholic, ammoniacal, or other stimulants, if there is much debility or prostration. The diet should be tempting and nutritious, supplied often, fresh and frequently varied, and care should be taken at all times to counteract any sudden suppression of the secretions of the bowels or kidneys, or even the nasal discharge. In this connection may be mentioned the statement of Mr. Murray, of Detroit, that all the cases of dropsy that came under his notice occurred in animals which had taken for a few days condition powders, consisting largely of sulphate of iron, and had had the nasal discharge suddenly dried up. Improvement followed promptly on the withholding of the powders and soliciting the action of the kidneys and bowels. Should the prostration become extreme, stimulants must be resorted to even more frequently than is recommended above; five, or even six times a day. In some instances, however, the system seems to lose all power of reaction, and almost the only remaining hope lies in the transfusion of blood from the veins of a healthy animal to those of the sick. The blood may be obtained from a healthy horse, or more conveniently from oxen or sheep intended for slaughter. It may be transferred through an elastic tube without exposure to the air, or it may be drawn off into a vessel and thence transferred to the veins of the sick horse, unchanged or defibrinated, remembering, that the main dangers to be guarded against are the entrance of air into the circulation, the introduction of clots of fibrin, which by blocking the vessels, would produce local inflammation and abscess, and the too rapid transfusion which leads to vertigo and fatal fainting. If the abdominal organs are especially involved, the counter-irritant is to be applied over the region of the liver, bowels, or kidneys, as the case may demand. With yellow or brownish appearance of the mucous membranes and tenderness over the short ribs, this point should be selected for its application. With general tenderness of the abdomen, colicky pains, frequent straining, and the passage of a white, thick mucus forming a pellicle over the dung, or collected in masses, it should be applied generally to the surface of the belly. If there is tenderness and swelling of the loins, stiffness of the hind limbs, frequent straining, the passage of water in small quantities and highly colored, and above all if the urine contains microscopic fibrinous casts, it should be applied over the loins. In the last case it may be preceded by a bag of hot, scalded bran, or a fresh sheep-skin with the fleshy side turned in. The shivering, which usually attends the onset of such complications, may be counteracted by friction to the skin, clothing, a warm drink containing a stimulant—four drachms carbonate of ammonia—and injections of warm water or well-boiled gruel, given to the extent of three or four quarts at a time, and repeated every hour until shivering ceases. In cases affecting the liver or bowels, I have found excellent results from guarded laxatives. Two, three, or even four drachms of aloes in different cases, with a drachm of gentian, and thirty drops of hydrocyanic acid, or an ounce of laudanum, will usually promptly relieve the colic, secure an action of the bowels, and remove the deadly prostration which characterizes this type. It has manifestly the effect of relieving the inflamed surface by a free secretion from its turgid blood-vessels, of benefiting the portal system and liver by a direct local depletion, and of eliminating poisonous material, which was being pent up to the great injury of the system at large. Little more is wanted than the free use of demulcents, such as slippery elm, well-boiled linseed, and the like, great care to secure a continuous moderate action of the bowels, and a tonic treatment as in other cases of convalescence. Turpentine has been strongly recommended by some, and acts beneficially as a local and general stimulant. An ounce of the crude drug, or half an ounce of the oil, may be made into a ball with linseed meal, or beaten up with the yolks of two eggs, and given twice daily. The affection of the kidneys may demand gentle laxatives, (oleaginous,) anodynes, (laudanum,) emollient injections, counter-irritants, stimulants, and later gentle diuretics. The nervous symptoms will sometimes demand the application of cold wet cloths to the head, counter-irritants to the sides of the neck and limbs, the guarded use of laxatives and diuretics, with drachm doses of bromide of potassium, and if there is great depression, ammoniacal stimulants. The rheumatic complication is to be met like ordinary rheumatism. Liquor of the acetate of ammonia two ounces, and colchicum wine, one ounce, may be given twice a day, diluted in water; tonics, warm clothing, the frequent application of a hot smoothing iron over the affected part of the body, with the intervention of a thin cover, and even counter-irritants are among the agents especially demanded. When the heart is implicated in rheumatic cases, the same treatment is necessary, but the blisters are to be applied behind the left elbow. When there is reason to suspect the existence of clots in the heart, alkaline remedies are recommended, particularly the preparations of ammonia and iodide of potassium, attention being meanwhile given to support the system by tonics and stimulants, and to encourage the elimination of deleterious products from the blood. If dropsical manifestations appear, they must be treated according to their apparent causes; if disordered function of the heart or kidneys, these must be met by appropriate measures; and if, from weakness of the circulation, an anæmic or debilitated state of the blood and imperfect nutrition, gentle action of the eliminating organs, with stimulants, tonics, a nourishing diet, (embracing, in some cases, strong beef soup or tea,) or even transfusion of blood, will be necessary. *Purpura hæmorrhagica* is to be met by similar supporting and eliminating treatment, with the addition of oil of turpentine in half ounce doses, or pure carbolic acid in drachm doses, and cinchona in half ounce doses, repeated thrice a day. The skin over the engorgements should be rubbed frequently with a solution of carbolic acid, containing one part of the acid to every hundred of water, and a similar lotion should be applied frequently to the sores when these form. In short, the various complications and sequelæ of simple influenza are to be treated like similar lesions occurring independently of this affection, but with due regard to the great debility attending this disease. The great majority of cases will recover without any treatment; and indeed many require no medical treatment, but a certain number will demand the greatest care of the educated medical attendant. Upon prevention, Dr. Law adds: Many have attempted to ward off the disease by the use of tobacco, camphor, vinegar, tar, assafœtida, etc., and others more rationally, by bromo-chloralum, carbolic acid, permanganate of potash, sulphurous acid, and the hyposulphites, but in no case with permanent success. With a contagium like that at present under consideration, so easily diffused through the atmosphere, absolute prevention will always be difficult, though not necessarily impossible. With a disease, too, the tendency of which is almost invariably to a favorable termination, it is scarcely politic to shut up an animal for a month in a disinfected atmosphere, until the disease has subsided, with the probability before us that he would still contract the disease from the remnants of the poison when exposed at the end of this period. Thorough cleanliness and disinfectants are to be highly commended, not with the view of absolutely preventing the disease, but rather with intent to retard and moderate it. The comparatively non-volatile disinfectants, such as permanganate of potash, chloride of lime, bromo-chloralum, and carbolic acid, may be used for the solid structures of the stable, drains, manure, and the like, while sulphurous acid is above all to be commended for disinfection of the air. This agent, when used frequently and in small amount, so as to be non-irritating, has the double advantage of soothing and giving tone to the diseased mucous membrane, and of destroying organic germs, including perhaps the morbific elements in the respiratory organs.

INFUNDIBULIFORM. Shaped like a funnel.

INFUSION. A liquor obtained by macerating herbs, etc., in hot or cold water.

INFUSORIA. The minute animalcules of infusions and stagnant waters; some possess a mineral casing; and the remains of innumerable myriads are found in rocks, such as tripoli, hence termed infusorial, or infusory rocks or formations.

INGLUVIES. The crop of birds.

INGUINAL. Connected with the groin (*inguen.*)

INK. To make black ink of the best quality, take twelve parts of gall-nuts, five of green vitriol, and five of gum; the galls are to be well pounded and boiled, and the other ingredients afterward added; one gallon of water is used for every pound of galls. Oak bark, logwood, and other substances are often used in place of the galls; the quantity must be two or three times greater. The indelible ink, for marking linen, is a solution of nitrate of silver, (lunar caustic). It is used with a clean pen on a place previously soaked with a little salt; the marking is to be exposed to light to blacken. It is removable by chlorine and ammonia.

INJECTIONS, TO GIVE. Injections are a favorite mode of administering medicines to animals, particularly to assist the action of medicines given by the mouth. If these are to be retained and absorbed, the horse or ox should not have more than two pints, but when the object is to produce evacuation, two and even three quarts are used. The use of injections will often supersede the necessity of medicines at the mouth, and weak solutions of permanganate of potash, or weak sulphurous acid, are often useful for washing the vagina after parturition, as a means of mild disinfection. Injections are also valuable as a means of introducing sedatives into the lower bowels, and for removing pin or thread worms. As a rule the barrel syringe is used. It is, however, much better to pump the liquid in by means of a fountain syringe if one can be had. The same thing may be accomplished by placing the medicine in a vessel three or four feet above the animal, conducting the liquid into the rectum, by means of a rubber hose communicating with the reservoir. Any liquid medicine given by the mouth may be used as an injection; but for assisting the action of other medicines warm (tepid) soapsuds is generally used.

INNER BARK. The liber of botanists, bass.

INNOMINATUM BONE. The bone of the buttock; aitch, or adze bone.

INOCULATION. The introduction under the skin of animals of a particular poison, fluid, or virus, to produce a specific disease, as smallpox. Budding and the transfer of grass turfs are also called inoculation by farmers.

INORGANIC. Not organic or destructible by heat, as the ashes of plants, minerals, etc.

INOSCULATION. The union of the extremities of veins and arteries.

INSECT. (See Entomology.)

INSECTIVOROUS. Birds, animals, or reptiles that prey on insects.

INSERTION. In botany, the direction in which an organ, as the stamens, is attached to the part that sustains it.

INSESSORES. Birds which perch on trees. Perchers.

INSOLATION. Scorched by the sun.

INSPIRATION. In physiology, the act of inhaling air.

INSTEP OF THE HORSE. The part of the hind leg reaching from the ham to the pastern joint.

INSULATION. In electricity, surrounded by non-conducting substances, as glass, resin.

INTEGERRIMUS. With a perfect edge, or margin, in botany.

INTEGRANT PARTS. The smallest parts of a body, by the union of which the mass is produced.

INTEGUMENT. A membranous covering or expansion. It is used in botany for the covering of seeds.

INTERCELLULAR SPACES. In botany, the minute spaces existing between the sides of cells. Along these the movement of sap occurs in herbs and the lower plants. In some water plants they are large to assist natation.

INTERFERENCE OF LIGHT. The effects produced by causing two pencils of light to be reflected or transmitted at very minute intervals or distances from each other, whereby they interfere and produce colors If the light be homogeneous they produce bright and black bands.

INTERFERING. This is the cutting of one leg ankle generally by another foot. The mischief is occasioned by the foot on the ground being set too near the line of the passage of the other foot. The usual remedy is to throw the leg out of line by raising the inside of the shoe slightly. If properly performed, in the generality of cases, the animal will not cut, after a time, with an ordinary shoe, since it is more a habit than a disability. If all other means fail, the point of contact may be protected by a leather shield. The same rule will apply to speedy cut, and other habits of cutting the leg high up.

INTERNODE. The space between two knots, leaves, or leaf buds, in stems.

INTERVAL LANDS. Lands on the margins of rivers. Alluvial lands.

INTESTINAL FEVER IN SWINE. (See Hog Cholera.)

INTESTINALIA. Worms inhabiting the interior of the bodies of animals. Entozoa. Those of the intestines are destroyed by purges and large doses (two ounces) of oil of turpentine.

INTRADOS. The lower line or curve of an arch.

INTRORSE. Turned inward.

INTUSSUSCEPTION. The folding of one portion of the intestines into another.

INULIN. A variety of starch. It is colored yellow by iodine.

INUNDATION OF LANDS. Fields are sometimes covered with water in agriculture, especially meadows, and in the cultivation of rice. The water is let in by sluices, and allowed to remain for several days or weeks, and, in meadows, during the whole winter. It kills those weeds which are not aquatic, serves to manure the soil, and, in the case of meadows, advances the grass by some weeks, the water protecting it from frost. The lands should be well drained, or on a porous soil; otherwise the water, sinking, will stagnate, and become injurious; it should be perfectly let out by numerous drains. By this practice, meadows have been rendered fertile without other manure for ages. The sediment deposited is sometimes called warp, and the inundation warping. The inundation of land by freshets, always causes renewed fertility. Those bottom and intervale lands, subject to periodic overflow, are the most permanently fertile in the country, bringing crops year after year, and generation after generation, without manure. Unfortunately some of these, as the great bottom lands along the Mississippi and Missouri, can not easily be protected from extraordinary floods, and hence great damage, complete destruction to crops, and even loss of life to the inhabitants as well as to live stock, sometimes occurs. The great floods of the Mississippi are not soon forgotten, and that of 1881, extending, as it did, the whole length of the valley, from St. Paul to the Gulf of Mexico, intensified, as it was by the inundations along the length of the Missouri, (the first severe one since the settlement of the upper Missouri valley,) entailing vast loss of property in crops, live stock, and even human life, will long be remembered, and should cause energetic steps to be at once taken to prevent it in future—a difficult problem but one by no means insurmountable.

INVENTION IN AGRICULTURAL ART. Invention in the processes simplifying agricultural labor and art have scarcely kept pace with those applicable to manufactures. Nevertheless, within the last ten years, such notable improvement in the adaptation of machinery to agriculture has been made, that scarcely any farm labor need now be done by the direct application of manual labor. Even the pitching of hay by horse power is now fairly accomplished, thus taking off one of the most severe forms of labor with which the farmer has to deal. Wheel implements are now universally used in the place of the hoe in cultivating the kitchen garden, and in extensive market gardening the application of gang seeders and cultivators have been successfully used; one used by the writer, having been capable of cleaning twelve acres per day, with three men and three horses, covering eighty inches of surface at every passage over the field. The modern mower, tedder, hay rake, loader, and stacker, leaves little to be desired in hay making. The grain fields are plowed with gang plows, seeded by means of drilling machines, and cut, gaveled and bound by one operation of the modern harvester. Corn land in the West may be well prepared and cultivated at an outlay of less than the labor of a man and team working less than one and a half days per acre, leaving the field ready for the huskers. Roads are graded by machinery at the rate of a quarter of a mile per day, ditches are dug, and even tile laid by machinery. The threshing and cleaning of grain, and in fact all the principal labors of the farm are now so simplified, that what was once the most exacting drudgery is now not any more laborious than other industries. In dairying, invention seems to have been at fault in one respect. A perfect and practicable cow-milking machine has not yet been invented. A number have worked measurably well, but can not be relied on for constant use. Chemistry, however, has come nobly to the help of the dairyman, and in connection with modern apparatus for setting milk, making butter and cheese, has placed the dairyman now on an equality with other branches of husbandry.

INVERTEBRATE ANIMALS. Animals without an internal skeleton or back bone (vertebral column), such as crabs (*crustaceans*), insects (*articulata*), or shell fish (*molluscans*), etc.

INVOLUCEL, INVOLUCELLUM. A small or partial involucrum surrounding the secondary umbels, etc.

INVOLUCRUM. A collection of bracts at the union of several flower stems. A covering of the fructification of ferns and equisetums. In anatomy, a name for the membrane covering the heart (*pericardium*).

IODINE. A body, of a black color. It closely resembles chlorine in its chemical characters; is not found in inland plants, but only in sea-weeds, and such as grow in salt marshes. It combines directly with metals, forming iodides.

With hydrogen, it forms hydriodic acid; with oxygen, it forms iodic acid. Iodine, as well as most of its compounds, is poisonous.

IOLITE. A dark blue mineral, massive, and crystallized in six or twelve sided prisms; found imbedded in primary rocks.

IPECACUANHA. *Cephælis ipecacuanha.* A shrubby plant, of the natural family *Cinchoniaceæ*, the root of which is used as an emetic. It is a native of tropical America. In twenty-grain doses it is emetic; but in smaller quantities, expectorant.

IPOMÆA. A genus of plants resembling the convolvulus.

IRIDESCENT. Exhibiting bright colors by reflection.

IRIS. There are many species, some tender, requiring green house culture, and others hardy propagated either from seed or by division. They are chiefly bulbous roots. The well known orris root, *Iris Florentina*, belongs to this family and besides, the well known value of the root, is brilliant in its bloom, and noted for the graceful curve of its petals. The familiar varieties of Flower-de-Luce of the gardens are irises. The name is from the Greek signifying the rainbow deified, anciently applied on account of the rich and various colors of its blossoms. In anatomy, the colored membrane of the eye which surrounds the pupil, and, by its contraction or dilation, regulates the amount of light entering.

IRISATED. Exhibiting the prismatic or rainbow colors.

IRON. A ductile metal, susceptible of taking a high polish. By exposure to damp air, it absorbs oxygen, becoming rust. Its ores are very numerous. Few soils are destitute of some admixture. The ashes of plants are also furnished with a small quantity. Cast iron contains impurities, which are removed, to a great extent, in wrought iron. The former is brittle, harder, and lasts longer when exposed than wrought iron, which is ductile, soft, malleable, and fibrous. Steel is a compound of carbon and iron, remarkable for its elasticity and hardness. Iron combines, also, with sulphur and halogen bodies. This is the black oxide, and exists in green vitriol and the proto-salts of iron, serving as a base. The peroxide is the common red or brown oxide; it is also a base, producing the persalts of iron. Iron is readily dissolved by acids, being first oxidized, and then uniting with the acid. The salts of the protoxide are, for the most part, instable, changing to peroxides when exposed to moist air. Iron is discovered in solution by an infusion of gall-nuts, which, sooner or later, produce a black color (ink). If the color arises immediately, the peroxide is present; if the mixture requires stirring and exposure to air, the protoxide is present. Many of the compounds of iron are of interest to the farmer. The protosulphate (copperas) is much used in dyeing, in making ink, and as an emetic. It is added to urine and fluid manures, to fix their ammonia, which it converts into a sulphate. It is also powerfully disinfecting, removing bad smells. This body is sometimes present in marshy and peaty soils, and makes them barren; they are recovered by liming. The pyrolignate of iron (persalt) is used in dyeing and the preservation of timber. The muriate has the same properties, and is also a medicine. Prussian Blue is a sesquiferrocyanide of iron.

IRON PYRITES. Native sulphuret of iron; it forms a mineral often crystallized, of a golden color. Its presence in soils produces barrenness, which is rectified by liming; it is the origin of most of the sulphur springs. Water flowing over the pyrites decomposes it in part, and becomes tainted with sulphuretted hydrogen.

IRON WOOD. (See Hornbeam.)

IRRADIATION. The brightness that surrounds luminous objects, and increases their apparent size.

IRRIGATION. In warm climates, where at certain seasons there is no rain, artificial watering must be adopted. Hence it became one of the first supplementary arts practiced in agriculture among the ancients, especially in Egypt. The appliances were crude, and the manual labor connected with it excessive; but in those early days the common people were slaves, their labor costing their masters merely the coarse food eaten, and the scanty clothing supplied. Modern intelligence has reduced irrigation to a science, wherever Europeans have penetrated, but in some Oriental countries nearly the same means are now employed as in ancient times. In irrigating the soil, the stagnation and evaporation of the water applied is to be guarded against. It would create as great an evil as drought. The circulation of the water is necessary. Hence, the more porous the soil, and especially the subsoil, the greater the vigor of the irrigated vegetation. Hence two principles have been established in irrigation. A sufficient supply of water during every period of the growth of the crop, and never to allow it to remain at rest on the land. In the cultivation of rice an exception is made. One of the objects of water here is to kill weeds. It is simply inundating the soil, and is called warping. Irrigation is the supplying of plants and the soil with water, either by showering, or by conducting the water over the land by means of artificial channels. In the United States the irrigation of water meadows has been practiced in some of the Eastern States. In the rice growing regions of the South, flooding is practiced, and in cranberry cultivation the same means must be available to secure the best results. In California, Utah, and Colorado, extensive systems of irrigation, involving the outlay of large capital, is common, and with the best results. In fact, in California, irrigation is considered essential in the reclamation of the swamp lands of the State, and that it would be of comparatively little use to reclaim from overflow the swamp-lands of the Sacramento or San Joaquin Valleys without providing at the same time an efficient system of canals and ditches for irrigating them during seasons of drought. The lowlands have an advantage in retaining their moisture to a later period in the season than the uplands; but experience shows that their productiveness is materially affected by drought, and that no reclamation is perfect which does not include the means of irrigation. The Commission appointed some years ago by the general government for the examination of certain lands and rivers in California with reference to irrigation, in their report say, the first point in a system of irrigation is to raise the surface of the water in the river to a level which will enable it to flow freely over the highest ground to be irrigated. This is usually done by a dam; but in the construction of dams, a great many mechanical, hydrostatic, and hydraulic principles must be applied under a great variety of circumstances. In the Old World, it is said, it is difficult to find two dams resembling each other. The size, alignment, and construction of the main canals constitute another branch of hydraulic engineering. The quantity of land to be irrigated, the nature of the soil, the minimum rain-fall, the kind of cultivation to be applied, and other considerations must be embraced in the programme of construction. The subordinate channels which are to convey the water down to the plow-furrows require the application of scientific principles. The following statement will show the methods which the commission considered practicable and suited to the peculiar features of the Great Valley. These methods are based on results of irrigation systems in the Old World. This account is taken from the works of San Joaquin and King's River Canal. The main canal has a slope of one foot per mile, the ground sloping at the rate of eight feet per mile. Water is not taken immediately from the main canals to the irrigated ground, but to the primary ditches, which follow the highest part of the ground and are about a mile apart. The section is partly in excavation, and partly in embankment. As a general rule water should not be taken from primary ditches, but through secondary ditches. Each secondary ditch irrigates the land between it and the next one below it, embracing about eighty acres. The land is subdivided, first, by plow-furrows, forty yards apart, parallel to the primary ditches. It is again divided by cross-furrows, called checks, fifty yards apart and parallel to the primary ditches. By closing the gate at the middle of the ditch, all its contents are discharged into the ten furrows above, through little gates at the head of each. The first check-furrow will arrest the flow and cause it to spread over the strip between it and the secondary ditch. When this is sufficiently irrigated, the check-furrow may be opened with the hoe, and the water will then overflow the second strip; and the process may be continued till the first forty acres are irrigated. Then close the small gates and open the gate in the secondary ditch, and in like manner irrigate the lower forty acres. As the ground slopes from the secondary ditches at the rate of eight feet per mile, the level of each check-furrow will be 2.7 inches below its predecessor. There will then be an inequality of depth of water at different points of a strip between the two furrows, but in porous soils there is a compensation in the percolation of the water in the check-furrows to the land just below them. In impervious soils, or in irrigation for alfalfa, or permanent pastures, the furrows and check-furrows must be more numerous. The surplus water is caught in catch-drains for irrigating land still further down the system. The irrigation of lands should not be undertaken except under due consideration. Irrigation is costly. It is not a current annual account simply, but an outlay to start with, that must be made as a permanent investment. The annual outlay is also considerable, amounting often to five dollars per acre. When hand labor is scarce and high this must be taken into account. Subterranean irrigation by means of drain pipes has been practiced in California. The plan has long been known in England, but in that moist climate is not recognized as of value. Warping, allowing the water to back over land, is used when there is tide water, and quickly produces results. In irrigation, sand and porous land receives the greatest benefit from irrigation; clay soils are least benefited, since they percolate water slowly, and one of the effects of irrigation is constantly to compact and harden the soil. Hence, cultivation should always follow irrigation between waterings, as soon as the soil becomes dry enough. Indeed, this is one of the best known means of conserving the water of irrigation by preventing undue evaporation, and in irrigation, the greater the descent and the quicker the flooding, the greater the benefit. It is also essential, that means be provided to secure the escape of superabundant water quickly, once the soil is saturated, since, as before stated, once water has done its work, stagnation is injurious. The history of irrigation and its advantages have been summed up as follows: The art of producing large crops by means of artificial supplies of water, has been practiced from remote ages in the warm countries of the world. It was used by the aborigines of America, by the Incas, the inhabitants of Mexico, extensively practiced by the Egyptians, the Romans, and at the present day in France and Germany. The Hindoos make no attempt at cultivation without artificial irrigation. The rivers of Italy are made subservient to agricultural wants wherever it is practicable. Arthur Young gives an account of an hour's run of water through a gutter, near Turin, which produced, in 1778. 1,500 livres. The rent of irrigated lands in Italy is much larger than upon land not watered. Moses, in speaking to the Israelites in the wilderness, said: The land whither thou goest in to possess it, is not as the land of Egypt, whence ye came out, where thou sowedst thy seed, and wateredst with thy foot, as a garden of herbs. Here the lawgiver alludes to the machines that were used in Egypt, which they worked with their feet, for raising water. Virgil tells how to bring down the waters of a rivulet upon the sown corn, and when suffering from heat, to convey the vivifying liquid from the crown of the declivity, in channels, to the roots of the plants. Columella, Pliny, Cato, Varro, etc., all dwell upon the importance of irrigation. It is found profitable in England to irrigate plantations of willows and other semi-aquatic trees upon dry soils. The efficiency of irrigation is dependent upon many considerations; one of the principal is the nature of the subsoil. When it is a tenacious clay, the preparation consists in suitable under-draining, that would be useless where the subsoil is sand or open gravel. Some waters are injurious. Certain salts of iron are known to be unfavorable to vegetation. Waters issuing from factories impregnated with animal and vegetable substances, such as the waters of distilleries, breweries, slaughter-houses, etc., are highly fertilizing; others issuing from chemical establishments, calico printing factories, are injurious. Salt water in small quantities may be found useful upon certain plants, such as the grasses, asparagus, etc., while they are positively injurious to such plants as rice. The salt marshes of France are known to produce a superior quality of mutton, which commands a high price, and is known in the French market under the name of pres salé. Waters impregnated with carbonate and sulphate of lime are very fertilizing. In certain parts of Germany, a weak solution of sulphuric acid has been employed for irrigating grass lands with great advantage. Those which hold in suspension mud and other detritus, are highly useful, particularly on sandy soils; the fine mud settles in the pores, and gives consistency, but any soil would be benefited by water holding mud in suspension, and that, of course, in proportion to the amount of organic and saline matter in the mud. Sir Humphrey Davy thought that the protection of grasses from frost during the winter season was of great importance, for a meadow irrigated in winter is preserved from sudden alternations, and from the effect of the roots being thrown out of the ground by alternate freezings and thawings. The water immediately in contact with the roots of the grass is rarely below 40° Fahr. In the month of March, in a meadow near Hungerford, the air was, at seven o'clock, a. m., at 29°. The water was frozen above the grass, and the temperature of the soil below the water in which the roots were growing was 43°. While the temperature is thus prevented from falling during the winter, it is kept cool during the summer. Irrigation supposes water in motion; if it be allowed to stand and stagnate, its effects would destroy the objects sought to be accomplished. Instead of fine grasses we would have a growth of carices, junci, and other coarse plants of no value. Sir John Sinclair says that the advantages of meadow irrigation are chiefly as follows: With the exception of warping, it is by far the easiest, cheapest, and most certain mode of improving poor land, particularly if it is of a dry and gravelly nature. Land once improved by irrigation, is put into a state of perpetual fertility, without any occasion for manure or trouble of weeding or any other material expense. It becomes so productive as to yield the largest bulk of hay, besides abundance of the very best support for ewes and lambs in the spring, and for cows and other cattle in the autumn of every year. In favorable situations, it produces very early grass in the spring, when it is doubly valuable. Not only is the land thus rendered fertile without having any occasion for manure, but it produces large amounts of food for animals, which is converted into manure, to be used on other lands, thus augmenting, in a compound proportion, that great source of fertility. The subject of irrigation is one of immense importance, in a dry, arid climate, such as characterizes portions of the western plains particularly. It is paramount, and may be employed throughout the continent with advantages greater than any other agricultural application. It is an important art of itself, and one that requires special acquirements for its adaptation. The direct action of the fertilizing constituents of water are not the only influences which that substance exerts upon our fields and growing crops. Its simple percolation through a soil has an important influence, by displacing gases and thus creating circulation of air and bringing a fresh supply of ameliorating agents. It is not necessary in this article that we go into details of the various systems of doing work in the articles treated. These must be sought in works written especially therefor, giving in detail the minutiæ. There are, however, many things to be considered before entering upon the work. First, the configuration of the land to know if it is adapted to irrigation, second, the water supply, to be sure that there is enough for every contingency. Then the nature of the soil, the character of the climate, and the nature of the subsoil must be taken into account. For instance, the greater the capacity of the soil for absorbing water, the longer it will retain it, so that a soil containing but a small amount of sand or gravel will not need irrigation nearly so often as one composed largely of sand; and yet the best results in irrigation, are reached, when water is abundant, in porous soils and subsoils, and for reasons heretofore stated. To give some idea of the water required per acre, it may be stated that a stream of water one inch wide and one inch deep flowing four miles an hour will cover an acre one inch deep in twenty-four hours. Hence, this would only suffice for seven acres to furnish an amount equal to the average annual rain fall which is fifty-two inches a year. In the irrigation of gardens recourse is often had to the common watering cart. This may do as a makeshift in times of drought, to keep special crops along until rain falls; no man would be foolish enough to depend upon this means in an arid climate. The only means here presented, where the water of natural streams can not be carried over the ground is by means of steam or wind power, and a system of underground pipes may thus be supplied, from a tank elevated twelve or fourteen feet, that will irrigate whatever the water supply will afford. Thus, with a tank holding 400 barrels, we have had a full water supply for 1,100 hot bed sash, besides affording all the water required at the house, barns, and wash-houses, no inconsiderable amount in a large market garden. A round tank, twelve feet deep and fifteen feet across will hold 15,000 gallons, and a square one sixteen feet across, and ten feet deep will contain nearly 20,000 gallons. Thus, such a tank if the water supply is sufficient to replenish it once a day, will furnish an inch a day over an acre of land. In times of extreme drought this supply will irrigate from five to seven acres of land. Thus the land may be irrigated by surface pipes discharging over the beds, in jets or it may be carried in open channels but at a waste of water.

ISOMORPHISM, ISOMORPHOUS. Having the same crystalline form; this is associated with the same number of atoms, but of unlike elements, and also with similar properties. Alum consists of sulphuric acid, alumina, and potash; but either of these bodies may be replaced by certain other isomorphous bodies; the sulphuric acid by the selenic, chromic, or manganic acids; the last two of these produce a difference of color in the crystal, but little else. The alumina may be replaced by peroxide of iron, sesquioxide of manganese, or sesquioxide of chromium; and the potash, by soda or hydrated ammonia. Thus, the alum may have none of its primary constituents, but isomorphous atoms of the same number. Isomorphism, or the study of these changes is of importance in agriculture, for it is found that the same substitution takes place in organic bodies. This is not, however, a matter of indifference; for the presence of soda in grapes, instead of potash, deteriorates their flavor; lime in the place of potash, in tobacco, injures its excellence; and lime or potash in place of soda, in onions and asparagus, is injurious to their mildness. The limit of isomorphous substitution is a chemical inquiry. (See Isomorphous Groups)

ISOMORPHOUS GROUPS. Potash, soda, hydrated ammonia, hydrate of lime. Of this group soda only replaces potash in cerealia; but lime, ammonia (or organic alkalies), can replace potash or soda in plants that do not require soluble silicates, as tobacco, potatoes, etc. Sulphuric acid is replaced by the telluric, selenic, chromic, and manganic acids. Phosphoric acid is isomorphous with the arsenic acid, but seldom found in soils. Iron, as the peroxide is isomorphous with alumina, oxide of chrome, and sesquioxide of manganese. These substitutions, although of no apparent moment, are continually occurring in plants.

ISOPYRE. A silicious mineral resembling obsidian, found in granite, basalt, and primary rocks.

ISOSCELES. A name given to an angle two of whose sides are equal.

ISOTHERMAL. Having the same average temperature. Geographical lines drawn over the surface of countries, and passing through places having the same average heat, are termed isothermal lines; they are very irregular, in consequence of the occurrence of mountains and surfaces of water, which modify the temperature. The terms Isotheral and Isochimenal are used; the first, to designate a line showing the places having the same summer heat, and the last, those with the same mean winter temperature. (See articles Heat and Meteorology.)

ISSUES, TO PRODUCE. A rowel or seton is used to produce an issue as a counter-irritant. A rowel is a wound made through the skin and integmuents, which are kept open by a pledget of tow, lint or other substance smeared with an irritant dressing. They can not be recommended. A seton is a strip of leather passed through a fold of the skin, and answers every purpose. These again can hardly be recommended, unless in very exceptional cases. (See Seton.)

ITALIAN RYE GRASS. *Lolium perenne.* (See Grasses.)

ITCH. Mange, scab, and itch, often prevalent in sheep and dogs, is produced by a minute insect (*acarus*) burrowing under the skin, and is highly contagious, since it may be left wherever the animal rubs itself to relieve itself of its misery. In hogs, mange is produced by the presence of an insect (*Sarcoptes suis*) which is transmissible to man. Scab in sheep is produced by a dermatocoptes, or itch insect, of which the horse, cattle and sheep each has its peculiar species. (See Scab, and Lice.)

IULUS. The generic name of the gally worm; insects with numerous feet, (*myriapoda*).

IVORY. The compact bony structure of the tusks of elephants; it contains sixty-six per cent. bone earth, and twenty-four gelatine. Ivory has long been a valuable article of export from Asia and Africa, but now its use is largely superseded.

IVORY BLACK. Bone black.

IVY. The term ivy is applied to a variety of climbing plants. The English ivy, *Hedera*, is probably the only genus to which the name is properly employed. There are two species, and a number of varieties. The Irish ivy, *H. comariensis*, like the English ivy, is a fast growing climber, but can not be said to be suited to our dry climate, even when it will survive the winter The Virginia creeper, *Ampelopsis quinquefolia*, is called American ivy. The poison oak, *Rhus toxicodendron*, is generally known as poison ivy. It is often mistaken for ampelopsis, the Virginia creeper. The poison ivy has its leaves in threes, the Virginia creeper in fives. It is also more robust. The climbing bittersweet, *Celastrus scandens*, is also called ivy. The so-called German ivy, is *Senecio scandens*, deservedly popular as an ornamental plant, on account of its rapid growth and freedom from insects. The so-called Coliseum ivy, is *Sinaria cymbalaria*, a species of snap dragon. Among the real ivies that are ornamental may be mentioned *Hedera digitata* or hand-shaped ivy, from its palmate leaves, and the Golden ivy, whose young leaves are golden yellow.

J

JACK. A general name given to engines for raising heavy weights.

JACOB'S STAFF. The cross staff used by surveyors in measuring heights and distances.

JALAP. The root of the *Ipomœa jalapa*, a convolvulaceous, Mexican plant, has a perennial root, or tuber. It is a powerful purge, the dose being ten to twenty grains for a man.

JAMAICA PEPPER. *Myrtus pimenta.* Allspice, the produce of an evergreen tree of tropical America. The berries are warm and aromatic.

JAMBS. The sides, or post of any aperture, or door which bears the cross piece on which the weight of the wall rests.

JAMESTOWN WEED. *Datura stramonium.* A poisonous weed. (See Stramonium.)

JASMINE. *Jasminum.* A family of climbing plants, in great esteem for their elegant foliage and fragrant flowers, blooming in the latter part of winter in the green-house or conservatory. Among the desirable varieties are the Catalonian jasmine, the odorous yellow-flowered jasmine, the white-flowered multiflorum, and nudiflorum with yellow flowers. There are over thirty species, including hardy, green-house, and hot-house climbers.

JASPER. An ornamental and colored silicious mineral.

JATROPA. A genus of euphorbiaceous, tropical plants, of which the *J. manihot* yields a root from which cassava is extracted; *J. curcas* has purging seeds resembling castor oil seeds.

JAUNDICE. Congestion and inflammation of the liver, called Hepatitis, results in what is called the Yellows or Jaundice. The eyes assume a more or less yellow tinge; the bowels are constipated; the animal is feverish, and there is a general debilitated and feverish appearance. The animal must first be brought into condition by gentle exercise and plain, nutritious, laxative food. Grass is best. If absolutely necessary to arouse the liver with mercurials, thirty grains of calomel, one drachm powdered aloes, two drachms soap, and four drachms powdered rhubarb, made into a ball with syrup, and given once or twice a day until an operation is had, may be used. This may be followed by a ball every day of one ounce of Peruvian bark and one drachm powdered nux vomica, mixed with linseed meal and syrup. Generally, however, saline mixtures are good. Take one pound each of Epsom salts, glauber salts and common salt; add one ounce essence of ginger, and mix in a gallon of warm water, and give a pint a day until the animal (horse or ox) is gently but fairly purged. Calomel should not be given to cattle.

JAY or BLUE JAY. Moose bird. The Jay is one of our most common and noxious birds, if for no other reason than its habit of destroying the young of other small birds while in the nest. The Canada Jay or Moose bird has been known to destroy the young from the nests of four pair of snow birds, *Junco hyemalis*, (sixteen in all) in a single half day. The Canada Jay, *Perisoreus Canadensis*, inhabits the northern portions of New England and Canada. The Blue Jay, *corvus cristatus*, is too well known to need description. It has no more good qualities than its Canada relation to recommend it, and the same bad habit of eating eggs and young of small birds. Of the two birds belonging to the family *corvidæ*, the crow deserves the protection of man far more than the Blue Jay. Prince Maximilian's Jay is a native of the Rocky Mountains and West, and is said to live principally on frogs, lizards and other reptiles. The Mexican and Beechy's Jay inhabits California and Texas. In the West and Northwest are also found the Ultramarine Jay and Steller's Jay, and in the South the Florida Jay. It is an open question as to whether the Jay is or is not beneficial to the farmer. In the summer he feeds upon pretty much every animal food he can find. In winter on grain. It is a noisy, quarrelsome bird and we incline to the opinion that it should be destroyed.

JUNIPERUS VENUSTA.

JEJUNUM. The portion of the small intestines next the duodenum.

JELLY. Gelatine with water; vegetable jelly is pectine.

JERSEY RED SWINE. Of this breed, which has acquired very considerable celebrity in New Jersey, but which has not been largely disseminated, the committee thereon, of the National Swine Breeders' Association, says: The positive origin of this family of swine is unknown. They have been bred in portions of the State of New Jersey for upwards of fifty years, and with many farmers are considered to be a valuable variety. They are of large size, and capable of making a heavy growth, five hundred and six hundred pounds weight being common. They are extensively bred in the middle and southern portions of New Jersey. In neighborhoods they were bred quite uniform, being of a dark red color, while in other sections they are more sandy and often patched with white. They are probably descended from the old importations of Berkshires, as there is no record of the Tamworth—the red hogs of England—ever having been brought into this country, nor is it likely, as the Tamworth were not considered a valuable breed, and were confined to a limited breeding. The Reds resemble the old Berkshires in many respects, but are now much coarser than improved swine of this breed. A good specimen of a Jersey Red should be red in color, with a snout of moderate length, large lop ears, small head in proportion to the size and length of the body. They should be long in the body, standing high and rangy on their legs. Bone coarse, hairy tail and brush, and hair coarse, inclining to bristles on the back. They are valuable on account of their size and strong constitutions, and capacity for growth. They are said to be not subject to mange, and undoubtedly are a most valuable hog for those sections where swine are expected to get their own living in the range, except at fattening time. Yet when swine are kept in a more artificial manner the finer breeds are more highly prized.

JERUSALEM ARTICHOKE. (See Artichoke.)

JET. A bituminous coal of fine texture, and taking a high polish.

JETERUS. The yellows of plants.

JOGGLED JOINTS. Joints of masonry or wood, which are made by indenting the faces and fitting them together.

JOGGLE PIECE. A truss post, whose shoulders and sockets receive the lower ends of the struts.

JOHN'S WORT. Plants of the genus *Hypericum*, especially *H. perforatum*, a common weed in meadows. Much prejudice exists against it, and being a perennial-rooted plant, it is not easy of extirpation. A kind of itch, and even inflammation of the stomach, are said to be produced by it in sheep, but salt is said to be a preventive, and the itch is treated with sulphur ointment.

JOISTS. The timbers to which the flooring is nailed.

JUBA. The mane, or crest of hair which runs along the back-bone of animals.

JUDAS-TREE. An ornamental genus, (*Cercis*,) of trees, of which the *C. Canadensis*, or red bud, is the only indigenous species.

JUGAL BONE. The cheek bone.

JUGULAR VEINS. The veins running on the sides of the neck, which bring the blood from the head. The external jugular is that from which blood is taken in the horse.

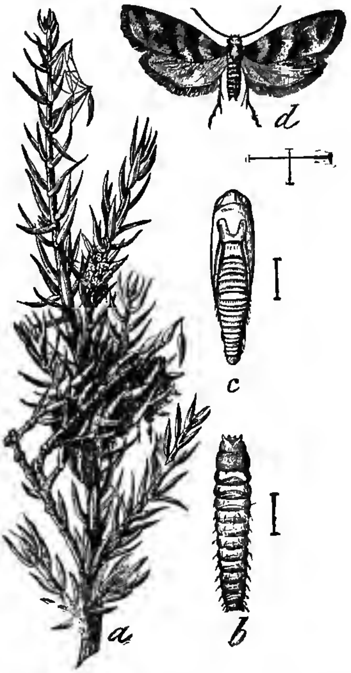
JUGULUM. The fore part of the neck in animals.

JUJUBE. *Zizyphus vulgaris.* The fruit of this shrub or small tree is red, with a coriaceous skin, and of the size of a large olive; it is a native of Italy and Spain. *Z. Jububa* is the true Jujube tree. A syrup made from the dried fruit and mixed with gum forms jujube paste.

JUNGERMANNIACEÆ. A natural family of acrogens, resembling mosses, and growing on the bark of trees, and in moist, shady places; the *Hepaticæ*, or true liverworts.

JUNIPER. *Juniperus.* This immense genus of evergreens comprises varieties from creepers and trailers to the largest trees of the forest, and are found in every portion of the earth, from the Torrid zone to the Arctic circle. Some species are valued for their lumber, others for the valuable resins, and others again for the fruit used in flavoring liquors, and in medicine. Among the true junipers are the common juniper, *J. communis*, a low, trailing shrub, the fruit of which is used for flavoring gin, and the oil is used in medicine. The Irish juniper is one of the most beautiful varieties of the common juniper. Erect in habit, dense and compact in growth, it may be used where formal growth is desired. The Swedish juniper is more hardy than the previous variety. It is light yellowish-green in its foliage, upright in growth, and, seldom seen more than ten to eighteen feet high, though trees fifty feet in height are said to be found in the forest of Fontainbleau, France. The weeping juniper, *J. rigida*, is another beautiful species, a native of the mountains of China and Japan. It is not hardy in the West, but where it will stand it is fine grafted into the common red cedar of the country. The red cedar, *Juniperus Virginiana*, is found in the United States from the Gulf of Mexico to the northern boundary on the great lakes. Its height is seldom more than forty to fifty feet, and with age becomes very striking. It is most valuable in its timber, being valued for its lasting qualities and the odor of the wood. One of the more ornamental forms of the Red cedar, *Juniperus venusta*, as illustrated on page 534, is one of the many exquisite forms this genus of plants assumes. It is a rapid grower, hardy, erect in habit, of beautiful silvery foliage, and one of the most ornamental of the upright varieties.

JUNIPER MOTH. In some sections of the country this insect (*Dapsilia rutilana*) a late importation from Europe, has appeared, but has had but a limited distribution. It is feared that, like many other imported insects, it may find a congenial home. While it is probable that it can never be exterminated, attention in carefully eradicating any noxious insects in the nursery stock before packing for shipment, would prevent their spreading to a great degree. The insect is single brooded, that is, produces but one generation in a season, hybernates at different stages of the larval development, and the chrysalides are found throughout the spring months. The worms appear in autumn, and should be destroyed, either by picking or by spraying the foliage thoroughly with a solution of Paris Green or London Purple. The cut illustrates the Juniper Moth and larva: *a* shows manner of work of larva; *b*, larva, dorsal view; *c*, chrysalis, dorsal view; *d*, moth, with expanded wings; the hair lines at the side show the natural size of the larva, chrysalis, and moth. The Entomologist of the Department of Agriculture, Washington, says the worm from birth webs the leaflets together, and lives within a more or less perfect silken tube, the tube being more complete around the hybernating individuals. The sprigs and branches affected present a more or less seared and brown appearance, so that a tree affected may be seen for a considerable distance. The Irish and Swedish junipers are said to be the varieties most infested, but it is quite probable that these varieties failing, they will then attack our indigenous varieties.



JUNIPERUS. The genus yielding the juniper berries. It contains also the *J. Sabina* (savine), *J. Virginiana* (red cedar) and many others.

JUTE. Jute is the fiber of two species of East India plants, *corchorus capsularis*, and *C. olitorius*, the latter sometimes called Jew's mallow. The first named is considered the most valuable. They are annuals, and grow to a height of from four to twelve feet. The jute of commerce is the fiber of the plant, which somewhat resembles hemp, but is much softer and finer. The butts of jute, for about nine inches, are used for paper making, and coarse fabrics; the finer and long stapled remainder is exported, while the short staple is manufactured into gunny cloth, of which gunny bags are made. Some idea of this great and growing industry may be formed from the fact that the export of jute from India reaches nearly 3,000,000 bales yearly, besides giving employment to an immense multitude in that country, men, women and children. The cultivation of jute has for years attracted attention in the South, and it is to be hoped that the cultivation and preparation of the fiber may in the end prove successful, since, if so, it will add another important crop to those of the South, and enable the country to become independent in respect to a commodity for which vast sums are annually expended by us in foreign countries. In relation to the cultivation of jute, the climate of Louisiana, Texas, and Florida has been found congenial to the plant, the chief difficulty in the successful following of the industry being the difficulty and cost of preparing the fiber, machinery not yet having been able to accomplish this successfully. A Boston merchant, Mr. N. G. Fuller, living in India, gives the following account of the cultivation in India: The quantity of jute fiber and seed produced to an acre depends greatly on the richness of the land. It is planted in Serajgunge, Naranigunge (Dacca) and other northeastern districts, where about four-fifths of the total crop is raised; the product is from two thousand to three thousand pounds of jute on an average; in some cases, however, as much as four thousand pounds are produced. The yield of seed is about one thousand to one thousand two hundred pounds per acre. In places, say about fifty miles around Calcutta, the production of which is called dessee, or country jute, the yield is smaller, being only about six hundred to one thousand pounds of fiber, and more seed, say one thousand five hundred to one thousand six hundred pounds per acre; but on rich, damp lands the product is almost as much as in the northeastern provinces. The dessee description was used only for local consumption until about five years ago, when shipments of it to England began, and both the shipments and production of it are increasing every year. Jute is sown broadcast, and about twenty-two to twenty-eight pounds of seed is required to an acre. In the northeastern provinces it is planted in February and March, and is cut about the end of June and beginning of July. The dessee is sown in July and August and cut in August and September. On rich land it grows and ripens quicker. In the northeastern districts, when grown on rich soil, the diameter of the stalk at the bottom is from three-fourths of an inch to one and a quarter inches, and the length from seven to ten feet, and sometimes, but rarely, longer and thicker. The country jute is from four to seven feet long and one-half to three-fourths of an inch in diameter. The plants are cut about three inches above the ground, excepting dowrah, which is uprooted. The butts are cut at the time of baling the jute for export to Calcutta. When the stalks are cut they have a green bark, which, after going through certain processes, become fiber; the planters can not tell at the time of cutting the stalks whether any or how far from the bottom will be hard. The stalks are cut about a month before the seed ripens, and the poorer plants are generally let go to seed. Jute made of the plants producing seed is hard and barky; the unripe seed, cut with the stalks, is of no use. It grows best on rich, moist ground, but not on low ground. Castor-oil cake is the best for it, and next to that cow-manure, but the country planters, as the ground is naturally rich, use no manure whatever. An acre of cotton costs much more than an acre of jute. Jute and cotton do not interfere with each other in the least. Cotton grows in the northwestern provinces, central and southern India, while jute is raised in Bengal. The little cotton that Bengal produces, and the little jute that the cotton districts produce, are of poor quality, and only used for local consumption. For the last few years jute has been encroaching on the linseed-crop, as the same ground is suitable for both. The best manner of cultivating this plant, in the South, is described as follows: To obtain good fiber-crops the land must be elevated, rich, moist, and well drained, as in India; to raise seed, low lands may be used, provided that favorable weather allows sowing and enables the growing plants to keep above the points of overflow. However, when the growth is fully started, water is not to be feared, so long as the tips remain above the surface of submersion. In the first case, jute is sown broadcast; in the second, in drills five feet apart. That interval is to facilitate the branching, and, at the same time, the destruction by plowing of the tall weeds which generally occupy low lands. In both methods the soil must be as well prepared as for ramie; plowed as deep as possible in January or February, then left exposed to atmospherical influences until the planting period. That period commences with April and terminates with June, in monthly succession. To prepare for sowing a second plowing is required, and as fine a harrowing as can be effected. The circular pulverizer, applied before the harrow, shortens the labor. Then the sowing for fiber-crop is performed with a broadcast sower. The quantity of seed required for each acre is from twelve to fifteen pounds. That is amply sufficient, and if the Hindoos put more in their land, there must be some accountable reason for that excess. Either the condition of their seed or of their land is inferior to that of America, or they are singularly prone to go to waste. We have repeatedly observed that, when the growth is thicker than what is allowed by the aforesaid quantum of seed, some natural destructive agent enters into the stand and thins the space to the limit demanded by the plant. This fact was verified in several spots of a jute plantation in Louisiana. Therefore no advantage at all can be derived from prodigality in sowing. The equal distribution obtained by the mechanical sower may account also for the economical difference existing between us and the Hindoo planters, who, having no machinery whatever, do all their work by hand. The ground being well tilled and the seed properly sown, on wet days if possible, the jute is left alone like wheat. No other care than that of drainage is necessary until maturity. The cost of that first operation can not exceed $4 per acre, if the material is adequate and the management judicious. That expense, of course, does not include the value of the seed, because, after the first outlay, planters will provide themselves with it from the low lands, or from the weak spots of the plantation. In the bottoms, when we plant in drills for seed, a subsequent plowing or two will be necessary in the intervals to neutralize the encroachments of grass. In Louisiana that labor is a necessity principally for the purpose of combating the tall weed called wild indigo, which occupies the low grounds. That tall weed, which is also fibrous, is the only vegetable that keeps pace in growth with jute; all other plants are distanced and smothered by the shade of the corchorus. In the field planted broadcast no parasite can resist the vigorous and absorbing influence of jute. Even the hardy and noxious gramineal plant, commonly called coco in Louisiana, is destroyed after two seasons of broadcast cultivation. Another peculiar advantage of jute planting is the antagonistic influence it exerts over insects, especially the lepidoptera tribe which generates the caterpillar. It having been stated in some reports of the Department of Agriculture that cotton-fields surrounded by jute-plantations were respected by the devouring worms, the director of the Ramie-Planting Association made special experiments to test the reported fact. Three different fields, planted with various sorts of cotton, were belted by jute. None of them were visited by the caterpillar, while the cotton of adjacent plantations was partly destroyed by the insect. That protection is attributed to the above-mentioned influence hostile to insects. It was observed that flies and butterflies kept away from jute-fields, especially at the blossoming period. The peculiar odor of the flower and the bitter exudation of the leaves seem to be strongly repulsive to them, if not poisonous. So important a fact deserves to be demonstrated once more on a larger scale. It would cost but little to plant belts of jute around the regular cotton-plantations which have been heretofore invaded by these injurious insects. The best period for cutting good crops of jute is during the stage that precedes the blossoming, or, at least, the seeding. The fiber is then fine, white, and strong. The monthly sowing graduates the maturing of the successive crops, which facilitates labor. April planting can be harvested in July, May planting in August, and June planting in September. Any late growth can be harvested in October, and even after, if no frost interferes. The plant stands green until frost dries it up; but even then it can furnish a good material for paper. The cutting operation is done with a mower or a reaper. The albumen of the plant makes it easier to cut than dry wheat. The reaper gathering the stems, bundles are made and carried as fast as possible to the mill where the textile is rapidly separated as described in our notice on ramie. Then comes the rotting operation. As fast as the fiber is turned out by the decorticating machine it is plunged into large vats filled with pure water and left exposed to the heat of the atmosphere. Kept under at least one foot of water, the filament is disintegrated by the dissolution of the gums or resins which united it in a sort of ribbon. That process of fermentation or rotting takes about a week in summer. With care and attention to the proper degree of rotting the fiber comes out almost white, lustrous, and fine like flax. The disintegration is known to be complete when the fiber assumes a pasty character. Then the rotted hanks are withdrawn, carefully washed in clear water, and hung up to dry in the shade. Care must be taken that the filament be well covered with water during the fermenting period, because atmospherical agencies tend to communicate to it a brownish color. After a few days of good weather it is ready to be shaken and twisted for baling like other textiles. That new process of rotting the separated filament instead of whole stalks combines different profitable results—the advantages of economy in labor, in value, and also in the integrity of product. Planters in the South should persevere in experimenting with this crop. If it can be proved that the plant is adapted to the soil and climate, American ingenuity will soon invent machinery for preparing the fabric cheaply. Jute is the fourth in point of export, of the commodities of India, only cotton, opium, and rice exceeding it in importance. The statistics of the development of the jute culture in India are very suggestive. In 1862, India exported 10,000,000 pounds of fiber and rope, and 300,000,000 yards of gunny cloth. In 1863, Great Britain employed more than 30,000 spindles in spinning 80,000,000 pounds of Indian jute. Some of the Indian factories are immense. There is an establishment at Barnagpoor, near Calcutta, which employs more than 4,500 workmen and annually manufactures more than 30,000,000 pounds of jute. In 1872, the total exportation of Indian jute was 700,000,000 pounds, of which Great Britain received upward of 395,000,000 pounds. In the same year more than 900,000 acres were devoted to the cultivation of jute in India; and in the thirteen provinces in which jute is principally raised, out of a population of 15,725,000, more than 1,350,000 were wholly or partially engaged in this occupation. These figures conclusively show the vast magnitude and importance of this industry to India. Why should not American talent and enterprise make its success certain here. According to the Department of Agriculture reports, for 1876, jute is mixed with cotton, linen, and silk. It is a material part of twilled stair carpeting and low-priced broadcloth. In combination with other textiles, it imitates the gloss of Irish linen, the luster of French silk, the beauty of Turkish rugs, and the splendor of Axminster, Kidderminster, Brussels, and Venetian carpets. Single or mixed, it enters into the manufacture of a thousand articles of commerce. In 1872, there were in Dundee about one hundred jute mills, employing upward of 20,000 workmen, and manufacturing more than 180,000,000 pounds of jute annually. In the same year, nearly 50,000,000 gunny bags—most of which were made in Dundee—were exported from Great Britain. Of the 300,000,000 pounds of jute that were manufactured in the United Kingdom in 1876, 200,000,000 pounds were woven in the mills of Dundee. The annual value of the flax, hemp, and jute manufactured in Dundee is now $15,000,000. Experiments in the culture of jute have been successfully tried in South Carolina, Florida, Georgia, Louisiana, and Texas. These trials conclusively established the fact that, wherever in the Southern States there is a hot, damp climate, and a moist soil of sandy clay or alluvial mold, jute can be profitably raised. The plant matures in this country in about the same time that it does in India. The April plantings were cut in July, and the June plantings were cut in September. Some of the stalks reached the height of fifteen feet, and in some instances the fiber was, according to the judgment of experts, superior in strength to that of India. The yield was in several cases at the rate of 3,500 pounds to the acre, yet this is probably an exceptional yield.

K.

KAINIT. (See Fertilizers.)

KALE. A name for some varieties of cabbage or borecole.

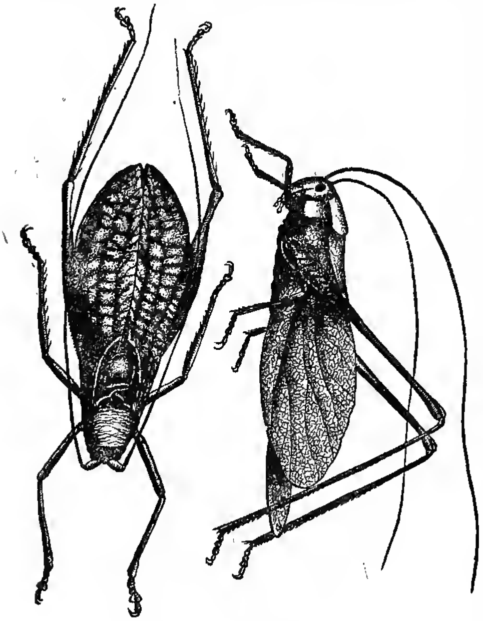
KALI. A contraction for alkali, potash; also, the ashes of *salsola kali* or barilla.

KALIUM. Potassium.

KALMIA. A genus of handsome flowering shrubs called American laurels. The leaves and flowers are poisonous, especially to lambs; those poisoned should be dosed with milk and castor oil.

KAOLIN. Porcelain clay, the fine, white, disintegrated feldspar of some primitive countries.

KATYDID. Under the heading Catydid, was given something in relation to that class of insects, except the locusts proper, which go under the general name Grasshopper. The Katydids belong to the order Orthoptera, which includes the earwigs, grasshoppers, true locusts, crickets, etc. Dr. Riley, in his sixth Missouri Report, says: We have in this country four Katydids that are tolerably common. They all dwell among trees and shrubs, and might far more appropriately be called tree-vaulters than grasshoppers. They are all of a green color, with very long, slender legs and antennæ, and the females are all furnished with curved or saber-shaped ovipositors, formed of two pairs of flattened sheaths which inclose two narrower pieces. The base of the front tibiæ or shanks is somewhat dilated, with an oval cavity each side, closed by a membranaceous covering. In the Oblong-winged species the first and middle shanks have such cavities, but in the other three species it is found only on the front shanks. Our most common species is the Angular-winged Katydid. The eggs of this species are more or less flattened, usually of a slate color, sometimes inclining to brown, and are deposited in two rows overlapping each other, and on the twigs of trees. The Narrow-winged Katydid is distinguished from the others by the length and narrowness of its wing-covers and by the male having a cylindrical style curving from below upwards. The female has the ovipositor much curved, and deposits her eggs in the leaves of trees. The Broad-winged Katydid has the wing-covers longer than the wings, and is distinguished from all others by the greater breadth and convexity of these wing-covers, which entirely enclose the abdomen. The eggs are deposited, says Dr. Riley, by means of the sharp ovipositors into crevices and soft substances, and probably in a state of nature, into the crevices of loose bark, or into the soft stems of woody plants. The Oblong-winged Katydid is not abundant in the West, and not found at all, we believe, in the latitude of and south of St. Louis. It is said to be at once distinguished by the perfectly oval form of the wing-covers, the long hind thighs, and by having the base of the middle, as well as of the front tibiæ, swollen and furnished with a membranaceous cavity each side. The female has an ovipositor, intermediate in size, between those of the Broad and Narrow-winged species, or almost as long as the abdomen, and it is more strongly toothed for one-half its length than in any of the others. The notes of the male are described by Harris as though grating, comparatively feeble.



KATYDIDS.

KEEL. *Carina.* The two lower petals of papilionaceous flowers are termed keel.

KELP. A term used both for sea weeds and their ashes. The ashes used for the manufacture of soap and glass, is now superseded in a great measure, by manufactured carbonate of soda.

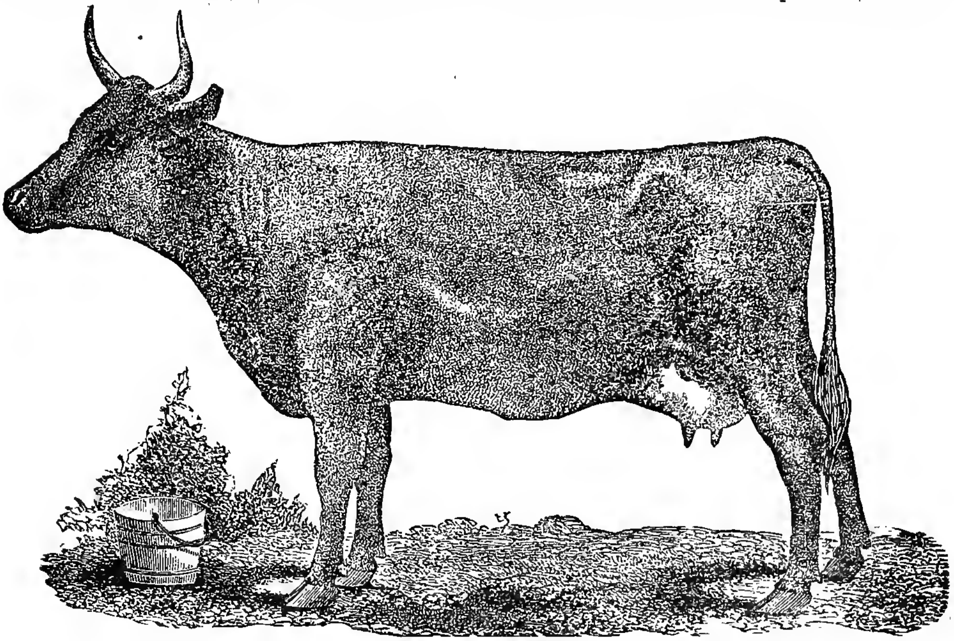
KENNEL. A hole inhabited by a fox or other animal. A shelter for dogs. A kennel is also used to designate a collection or pack of hounds.

KENTUCKY COFFEE TREE. *Gymnocladus.* This unique tree is found in the western part of the State of New York, and as far north as Montreal, in Canada. But it is seen in the greatest perfection in the fertile bottoms of Kentucky and Tennessee. Sixty feet is the usual height of the coffee tree in those soils; and, judging from specimens growing in various situations, it will scarcely fall short of that altitude, in well cultivated situations, anywhere in the Middle States. When in full foliage, this is a very beautiful tree. The whole leaf, doubly compound, and composed of a great number of bluish-green leaflets, is generally three feet long, and of two-thirds that width on thrifty trees; and the whole foliage hangs in a well rounded mass, that would look almost two heavy were it not lightened in effect by the loose, tufted appearance of each individual leaf. The flowers, which are white, are borne in loose spikes, in the beginning of summer, and are succeeded by ample brown pods, flat, and somewhat curved, which contain six or seven large grey seeds, imbedded in a sweet, pulpy substance. As the genus is diœcious, it is necessary that both sexes of this tree should be growing near each other, in order to produce seed. Downing says, the Kentucky coffee tree is well entitled to a place in every collection. In summer its charming foliage and agreeable flowers render it a highly beautiful lawn tree; and in winter, it is certainly one of the most novel trees, in appearance, in our whole native sylva. Like the Ailanthus, it is entirely destitute of small spray, but it also adds to this the additional singularity of thick, blunt, terminal branches, without any perceptible buds. Altogether it more resembles a dry, dead, and withered combination of sticks, than a living and thrifty tree. Although this would be highly monotonous and displeasing, were it the common appearance of our deciduous trees in winter; yet, as it is not so, but a rare and very unique exception to the usual beautiful diversity of spray and ramification, it is highly interesting to place such a tree as the present in the neighborhood of other full-sprayed species, where the curiosity which it excites will add greatly to its value as an interesting object at that period of the year. The seeds vegetate freely, and the tree is usually propagated in that manner. It prefers a rich, strong soil, like most trees of the Western States.

KERMES. Insects of the genus *Coccus*, or bark lice, collected from numerous plants, as the oak, etc., and formerly much used for dyeing a red color, but to a great extent superseded by cochineal.

KERMES MINERAL. The hydrosulphuret of antimony.

KERRY CATTLE. The Kerry cow, a most valuable milking strain indigenous to Ireland, but not, we believe, imported to the United States, except occasionally by amateurs as a curiosity, are eminently adapted for taking care of themselves on the hills with but little care from their owners. Hardy as they are, they can scarcely compete with our more valuable milking breeds, when feed is so cheap as it is all over the United States. In some sections of the more mountainous regions they might, indeed, find a limited range, but here the Swiss cow would probably surpass them. Youatt calls them truly the poor man's cow; living everywhere hardy, yielding for her size abundance of milk of a good quality, and fattening rapidly when required; but they are rather apt to be coarse in the head and deficient in the hind quarter, with a certain cloddiness of the shoulder. They are short-legged, with good hides covered with thick, long hair; their horns are fine, short, and turned upwards; their colors are black, brown, or brindled. They are exceedingly hardy and active, almost disposed to wildness; and live on the mountains and moorlands of their native country without shelter or care. The quality of their milk is very good. In an experiment made between the Ayrshires and grade Kerrys—the


KERRY COW.

cross being with the long-horned Irish, and not calculated to improve the milking of the former—the milk of the Scotch breed required nine and nine-tenths quarts to make a pound of butter, whilst eight and one-fifth quarts of that of the Irish cows yielded a pound of butter; making a yield of one-sixth more butter in favor of the Kerrys. Mr. Bogan, who conducted the experiment, states that the color of both the milk and butter of the latter was the richer of the two. It must be taken into consideration, though, that the Ayrshires were just imported from Scotland, and had not time to become acclimated. A further experiment, made by the same parties, on the crown estate at King Williamstown, between Galloways, Ayrshires, and Kerrys, resulted as follows: The Galloways averaged six and a quarter quarts per day, requiring nine and one half quarts to produce a pound of butter; the Ayrshires gave nine quarts of milk per day, requiring ten and one-fifth quarts to produce a pound of butter; the Kerrys gave seven and a quarter quarts per day, requiring eight and seven-eighths quarts to produce a pound of butter. The Galloways were but three years old, with their first calf; the Kerrys were four years old, and the Ayrshires six years old In both these trials the Kerrys proved themselves good dairy cows. The cut shows a cow of this breed as it is known in Ireland.

KETCHUP. Catsup.

KEUPER. The upper portion of the new red sandstone formation.

KEY. In building, a piece of wood let into another in the contrary direction of the grain.

KEYSTONE. The central stone of an arch.

KID. A young goat. (See Goat.)

KIDNEY BEAN. (See Bean.)

KIDNEYS. The reins. The organs in which urine is secreted, from whence it flows along tubes (ureters) into the bladder. They are situated in the loins and attached to the spine.

KIDNEY-SHAPED. Reniform, of an oval figure, with one side indented, so as to resemble a sheep's kidney.

KIDNEY VETCH. *Anthyllis.* An ornamental flowering plant.

KIDNEY WORM. There are various parasites infesting the kidneys of the hog, and the fat which surrounds them. The lard worm, (*stephanaurus dentatus*) seldom causes serious trouble. The kidneys are sometimes affected by a larger and somewhat similar worm (*Eustrongylus gigas*) found in the pelvis or hollow curved portion in which the secretion of urine takes place. These occasion a weakness, or partial paralysis of the hind limbs, and an inclination to sit or lie down. Pouring turpentine on the loin of the back is a favorite remedy, and, as a stimulant, it sometimes does good. The difficulty is in determining the existence of the worms. The kidneys are also infested sometimes with hydatids or bladder worms, far more serious than the latter. If it were possible to know surely of their existence, moderate and continued doses of turpentine would be indicated. Unfortunately, even veterinary surgeons are not always sure from the symptoms, as shown.

KILLING ANIMALS. It is customary to keep oxen two days, and smaller animals one day, without food, but this is neither humane nor proper. The ox is killed by a blow on the forehead, and his throat immediately cut. The Jews, who eat no meat with blood in it, do not fell the animal, but, having tied it, divide the throat down to the bone. Animals killed by accidents are eaten with propriety, but such as die from disease are unwholesome, and sometimes poisonous. A method of killing animals by pithing, or dividing the spinal marrow high in the neck by a sharp knife, is practiced in southern Europe; the animal falls at once, but the flesh is said not to be free from blood.

KILLINITE. A greenish lamellar mineral, consisting of silica, alumina, and iron, with six per cent. potash.

KILN. A furnace. The figure depends on the object in view.

KILN ASHES. The ashes of the wood, straw, etc., used in burning.

KILN-DRYING. Drying hops, malt, grain, etc., in a chamber, or over a wire-work heated to 120° Fahrenheit, and upward by a kiln or stove below.

KILOGRAMME. A French weight, equal to two lbs., three oz. five pwts., avoirdupois.

KING BIRD. *Tyrannus Carolinensis,* known also by the name of the Tyrant Fly-catcher, and, Bee Martin, is a common summer bird all over the North, arriving generally just before corn planting time, or when insects begin to be plenty. Its nest is placed in the fork of a tree, generally in and near the orchard, seldom more than twenty feet from the ground. It has the reputation of catching bees. There is no real evidence, however, that it does catch living bees. Its food is beetles, grasshoppers, and insects in general. In defense of the king bird, Mr. Townsend Glover says: The stomach of one examined in May contained May beetles, but no bees. Another shot by a farmer, who suspected it of taking his bees, as he had seen it make repeated dives among them from a willow overhanging his hives, contained no less than fifteen *anomala varians*, one *carabus*, and not the vesttige of a bee. These insects were so packed together and mixed up in the stomach, that an inexperienced person would have taken them for a mass of bees; and it was only after careful and close examination that they were all indentified. This bird may, however, feed upon bees at some particular seasons; and if farmers would only carefully examine the stomachs of such as are killed, or send them for that purpose to some competent naturalist, the question would soon be settled as to whether it ought to be shot as a marauder upon bee-keepers, or protected as a benefactor of farmers.

KING-POST. The central post of a trussed framing for supporting the tie beam.

KINIC ACID. The acid with which quina is associated.

KINO. A dark-brown astringent extract containing much tannin.

KIRSCHWASSER. A liquor obtained by fermenting cherries, with which the stones are pounded, and distilling the fermenting liquor.

KNEE. In architecture, an artificially or naturally bent timber. Knees are most largely made use of in the building of vessels.

KNEEPAN. A small, flat bone (*patella*) situated before the knee-joint to protect it.

KNOLL. A hillock, or small hill.

KNOPPERN. Gall-like excrescences of oaks, used for dyeing and tanning.

KNOT GRASS. A weed-like plant (*Polygonum aviculare*); also a *Holcus*, which produces bulbs on its roots.

KNOT-WEED. *Polygonum.* There are many varieties of polygonum, including buckwheat, wild (false) buckwheat, knot-grass, smart weed, water pepper, etc., and all worthless to the farmer, except the cultivated buckwheat (*Polygonum fagopyrum*).

KOHL-RABI. *Brassica caulo-Rapa.* A vegetable partaking of the nature of the turnip and cabbage, and hence sometimes called turnip cabbage. The leaves resemble the Swede turnip and it is peculiar in the bulb-like swelling above ground, which is the edible part. It is in great repute among our German population, and growing in favor among all classes, especially since the attacks of the cabbage caterpillar, has rendered that vegetable a precarious crop. The vegetable is fit for use when half grown. If allowed to attain its full growth it becomes hard and stringy. It is cooked by being sliced and boiled like the turnip, and resembles both the cabbage and turnip in flavor. The seeds are sown for the earliest crop in a cold frame, and thence transplanted in rich soil, in rows eighteen inches apart by twelve to fifteen inches in the row. When raised for feeding stock, the seed should be sown in May, in rows two feet apart, the plants to stand twelve inches in the row. For family use in winter the seed is sown in June and the plants set out when large enough. They are kept by packing in dry sand. The cultivation is precisely like that of cabbage. The Early White Vienna may be sown for family use, and for stock, the large white or the large purple, which sometimes grows to a weight of eight or ten pounds.

KRAMERIC ACID. It is obtained from the root of the *Krameria triandra* or rhatany.

KYANITE. A silicate of alumina, sometimes colored by iron and other bodies; it occurs in doubly oblique prisms; is white, gray, or blue. It is common in primitive formations, and sometimes forms a fine blue stone resembling sapphire. and used by jewelers.

KYANIZING. A process named from its inventor, Mr. Kyan, for preserving timber and other vegetable substances from decay by the use of antiseptic materials. Corrosive sublimate was the material which Mr. Kyan employed for the purpose, but chemistry has shown that other substances can be used with equal advantage, and much less expense; arsenic, sulphate of iron, sulphate of copper, and some other substances have been used with more or less advantage by the French chemists, who have taken the lead in this art. Chloride of zinc was successfully employed by Burnet, a surgeon in the British navy, several years ago, for kyanizing rope yarns, and this was the substance used at Maysville. Kentucky, for kyanizing cordage made of unrotted hemp. It was prepared by dissolving zinc in muriatic acid, and this diluted with water in a large tub to such an extent as to give but a slight alum-like taste to the chloride when placed upon the tongue. The yarns were immersed in the solution for about twelve hours, drawn out with a heavy reel over the tub to drip for an hour or two, then stretched out to dry. This made the rope almost indestructible from ordinary exposure to the weather. The kyanizing of material is not now much practiced other processes having superseded it. It was at one time supposed that it would be valuable on the farm in the preservation of posts, but the cost of preparation and injecting the material precluded its adoption. In fact all chemical processes are too costly for the farm.

L

LABELLUM. The flower petal of a labiate or orchideous flower.

LABELS. In all experiments with plants, it is especially necessary that they have labels attached to them, by which the correct name of the plant may be determined, and the record pertaining to the experiment kept easy of access. Many labels have been invented both of wood and metal. When it is necessary that the label bear the name distinctly, for a long time, labels of zinc running to a long point, and upon which the name may be marked in oil paint, are undoubtedly the best. For ordinary use, we have found the common wooden labels, brushed over with thin white lead paint and then marked with an indelible pencil, to answer every purpose. These are now made of all sizes, both for wiring and thrusting into the ground. When but few are required, they are easily made at home, out of soft, clear pine. For marking nursery rows, where there are many names, marking by Roman numerals, and recording the name with accompanying numeral in a book, should be practiced. The same is true of any plants, the name of which is to be preserved, either in ordinary farming operations or in horticulture. Thus, if several varieties of grain are to be tested, they should be correctly marked by having numbers carefully cut in. Then the record should be kept in a book containing data, that may occur in connection with the grain, or plant, from time to time.

LABIATÆ. An extensive family of plants, characterized by a two-lipped, monopetalous corolla, an irregular number of stamens, and four-lobed ovary. They are mostly herbs or small shrubs, with highly aromatic flowers and leaves, as the mint, lavender, sage, etc. None of them are poisonous.

LABIUM. A lip, the divisions of some monopetalous flowers. In entomology, the movable organ which is at the front of the head, or face, covering the mouth, and representing the upper lip.

LABORATORY. The workshop of the chemist; chemical manufactories are often improperly so called.

LABRADORITE. An iridescent, opaline variety of feldspar.

LABRUM. The labium, or upper lip of the insect.

LABURNUM. *Cytisus laburnum.* The varieties generally cultivated are the common broad-leaved; the narrow-leaved, long-spiked, the short-spiked; the variagated, and the intermediate or dwarf laburnum. The first two come fairly true from seed, the others are propagated from cuttings eight to twelve inches long, kept over winter and planted in the spring like currants. *Laburnum vulgare.* The common sort makes a nice shrubby tree, with fragrant flowers, but in the West requires protection in winter, until it is thoroughly well rooted, or until it has obtained some size.

LAC. The dry resinous juice of several trees of Southern India. The trees are wounded by the *Coccus ficus*, a bark louse, parts of which being entangled in the juice, produce a red color like cochineal.

LACERATED. A botanical term, used to designate a leaf which appears to have been torn.

LACERTIDÆ. The family of lizards.

LACHRYMAL GLAND. A small conglomerate gland placed in the upper portion of the outer angle of the eye; it supplies the eye with moisture to lubricate the surface; an excessive flow produces tears. The lachrymal duct is a small channel from the inner corner of the eye to the inside of the nose.

LACINIATE. Fringe-like; petals, leaves, etc., cut into numerous thin shreds.

LACQUER. A varnish used to cover brass and other metals, made by dissolving shellac in alcohol, and coloring with gamboge, saffron, and other bodies.

LACTARY. A dairy.

LACTATION. Giving milk, or suckling.

LACTEALS. Minute vessels running from the interior of the small intestines along the mesentery to the thoracic duct; they convey the chyle or nutritious portions of digested food. They form the lacteal glands of the mesentery.

LACTIC ACID. The acid of sour milk, and also found in digested food, and sour, starchy substances, saur kraut, etc. It is a thick, colorless, sour liquid, soluble in water and alcohol; and coagulates milk. It readily combines with bases forming lactates.

LACTINE. Sugar of milk.

LACTOMETER. An instrument for measuring the purity of milk by specific gravity, or for ascertaining the proportion which the cream bears to the milk of any particular cow.

LACTUCARIUM. The dry juice of the wild lettuce. (*Lactuca viposa.*)

LATUCIC ACID. It exists in the lactucarium.

LACUNA. A small pit. The mouth of the excretory ducts.

LACUNOSE. Having little pits or shallow indentations.

LACUSTRINE. Belonging to a lake, as lacustrine deposits.

LADY BIRDS. *Coccinellidæ.* These are among the most beneficial of the insect tribes to the farmer and the horticulturist, from the fact that they prey on other insects in all stages of their growth from the larva to the perfect beetle. They were named from Coccus, the insect which produces the cochineal of commerce, from the prevailing bright red color of the species. Dr. Le Baron says that upwards of twenty North American species have been described and distributed in a number of sub-genera, founded for the most part upon obscure or unimportant characters. There is a greenish, black spotted insect that should not be confounded with the lady birds, since it is a vegetable feeder, and a near relation to the three-striped cucumber beetle, and is known as the twelve-spotted diabrotica, or spotted squash beetle. All the coccinella, or lady birds, excepting, it is said, *Epilachna borealis*, one of the largest species, are beneficial, by destroying plant lice, (bark lice,) scale insects, including the orange scale insect, and various eggs and larvæ, especially those of the Colorado potato beetle, which, in the egg state, is preyed upon by a number of species of lady birds. They deposit their eggs in the midst of the aphides, and, when hatched, the young larvæ immediately commence feeding voraciously upon them, and continue to destroy them until they change to the pupa state; then they remain motionless, fastened to a leaf or branch, until they again change to the perfect insect—in this stage to feed on other insects and propagate their species. *Chilocorus bivulnerus*, a small black lady bird, with two red spots on its wing cover, is very useful in destroying bark lice, which are so injurious to fruit trees. I have observed them early in the spring attacking the pine tree scale, ripping open the cases and devouring a few of the eggs, leaving the rest to fall to the earth when the trees are agitated by the wind, in this way destroying many of this injurious coccus. *Exochomus guexi*, a small red lady bird with two black spots is of similar habits. It is of great utility, by destroying the orange scale insect, which has proved so very destructive to the orange tree in Florida. If any farmer wishes to satisfy himself as to the utility of the lady bird, he can easily do so. By minutely examining his rose bushes in the summer, when covered with lice, he will find an elongated bluish black insect, somewhat resembling an alligator in shape, with more or less orange or yellow spots on the back and sides. This is the larva of a red or black-spotted lady bird, and if placed under a tumbler with a fresh twig of the plant covered with plant lice, after a few days it will cease eating, fasten itself to a leaf, shed its skin, and assume the pupa state; and in a few days more change again into the perfect insect. As a means of illustrating some of the more common species of these beneficial insects, we give a series of cuts—beetles, larva and eggs—with explanatious from one of Dr. C. V. Riley's Missouri Reports, which says: In the egg state the Colorado potato beetle is preyed upon by no less than four distinct species of lady birds. Foremost among them is the Spotted lady bird (*Hippodamia maculata*, DeGeer) which is one of our most common species and is of a pink color, marked with large black spots as in **Figure 1.** Next comes the Nine-spotted lady bird (*Coccinella 9-notata*, Herbst) which is of a brick-red color and marked with nine small black spots as in Fig. 2. Next, the Thirteen-spotted lady bird (*Hippodamia 13-punctata*, Linn.) which is also of a brick-red color but marked with thirteen black spots as in Fig. 3. (To these we have added the black, two-spotted lady bird, *Chilocorus bivulnerus*, Leach, Fig. 4. This is black, with a red dot on each wing cover and is useful in destroying the lice of the apple, plum and other trees. Edt.) And last but not least, the little species fig-

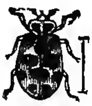


Fig. 1.

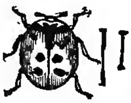


Fig. 2.

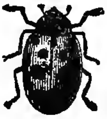


Fig. 3.

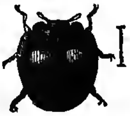


Fig. 4.

ured at 5 which may be known as the Convergent lady bird (*Hippodamia convergens*, Guer), and which is of an orange-red color marked with black and white as in the figure. This last species alone has been of immense benefit in checking the ravages of potato beetles. Its larva is represented of the natural size at Fig. 5 *a*, its colors being blue, orange and black; when full grown it hangs by the tail to the under side of a stock or leaf and transforms into a pupa represented at Figure 5, *b*. In this state it is of the exact color of the Colorado beetle larva and is doubtless quite often mistaken for that larva and ruthlessly destroyed. It may readily be distinguished however by its quiescence, and let every potato grower learn well to recognize it and spare its life! The larvæ of all these lady birds are more bloodthirsty in their habits than the perfect beetles, and the larva of the little Convergent lady bird is so essentially cannibal that whenever other food fails, it will turn to and devour the helpless pupæ of its own kind. All these larvæ bear a strong general resemblance, and with the aid of Fig. 5, *a* and Fig. 6, a good idea may be obtained of them. They run with considerable speed, and may be found in great numbers upon almost any kinds of herbage. The larvæ of certain species that prey upon the Hop Plant-louse in the East are well known to the hop-pickers as black niggers or serpents, and are carefully preserved by them as some of their most efficient friends. The eggs of lady birds greatly resemble those of the Colorado potato beetle, and are scarcely distinguishable except by their smaller size and by a much smaller number being usually collected together in a single group, As these eggs are often laid in the same situation as those of the potato-feeding insect, care must be taken by persons who undertake to destroy the latter, not to confound those of their best friends with those of their bitterest enemies.

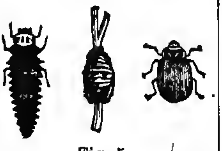


Fig. 5.

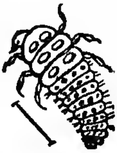


Fig. 6.

LADY-BUG. (See Lady birds.)

LADY'S MANTLE. Plants of the genus *Alchenuilla;* they are slightly astringent, but wholesome.

LADY'S SLIPPER. Flowers of the genus *Cypripedium,* of great beauty.

LADY'S TRESSES. Small orchideous plants of the genus *Spiranthes,* of no importance.

LÆVIS. Smooth.

LAGENÆFORM. Bottle-shaped.

LAGOON. A shallow lake, into which the sea flows.

LAGOPUS. The genus containing the grouse and similar birds feathered down to the toes.

LAMBDOIDAL SUTURE. The line of junction between the bone at the back of the head (occipital) and the side bone (parietal).

LAMB SKINS. Their value depends on the fineness, brightness, and color of the wool, black being most esteemed. The skin is extensively employed in making gloves.

LAMB'S LETTUCE. Corn salad.

LAMB'S QUARTER. (See Goose-foot.)

LAMELLÆ. The gills of mushrooms.

LAMELLICORNS. A division of pentamerous beetles, in which the short antennæ are inserted into a deep fossa at the side of the head; the body is ovoid and heavy; the anterior part of the head is commonly dilated, and projects; the mentum is large, covering the labrum or incorporated with it, and bearing the pupi. They are very numerous, and feed on excrements, rotten wood, and roots.

LAMINA. The flat surface of a leaf.

LAMINÆ. A tribe of longicorn beetles, distinguished by a vertical head, filiform palpi, antennæ bristly and simple, thorax nearly equal throughout; some species are apterous.

LAMINATED. Rolled or beaten to thin leaves or foil.

LAMINITIS. (See Founder.)

LAMPAS. The horse is subject to various local inflammations in and around the mouth, which prevents the proper chewing of the food, causing working of the jaws, ejection of the food, and often drooling of saliva from the mouth. Persons who do not apprehend the real cause apply to the nearest horse doctor (?) who, in his ignorance, burns the lampas out. Lampas is an active inflammation of the fleshy bars of the roof of the mouth, not unusual in young horses while shedding their teeth. Sometimes they swell so much as to project beyond the nippers, and are so tender that hard food is refused. Scarifying the bars with a sharp lancet, so they will bleed slightly, is the proper remedy. If this does not suffice, touch the inflamed parts with a stick of lunar caustic, or swab them with a strong solution of the same every day until they disappear, or the inflammation is reduced. The glands of the lower jaw sometimes encroach on the cavity of the mouth, through enlargement. The glands should be painted with iodine until the swelling disappears. This form of swelling is called Vives. Paps is a name given to swellings caused by obstructions of the salivary glands. Touching with a pencil of nitrate of silver once a day, until it disappears, is the remedy. In cutting teeth, the gums of young horses are swollen, as in the case of infants. Cutting down onto the teeth with a sharp knife will give relief. Old horses are often supposed to have lampas, when the trouble is either decayed teeth, or from the increasing spaces between becoming filled with closely impacted food, so much sometimes that inflammation and even excoriation will ensue, causing foul breath. In fact, if the horse have a foul breath, the first thing to be looked for is decayed teeth, or else food lodged between. If decayed teeth are found extract them, if impacted food be found remove it and wash the parts with a solution of chloride of lime, in the proportion of one ounce of chloride of lime to a pint of water.

LAMPBLACK. Fine charcoal obtained by imperfectly burning resins, etc.

LAMPYRINÆ. A tribe of soft-skinned, serricorn beetles, characterized by palpi with enlarged terminations, a soft, straight, slightly depressed body, by the thorax projecting over the head, which it partially or wholly covers.

LANATE. Covered with wool, or having the appearance of wool.

LANCASHIRE SWINE. This is an English breed and it is divided into three sub-families. The Short-faced Lancashire, the Middle Breed

Lancashire, and the Large Lancashire. They are all pure white, and their characteristics, were described as follows, at a convention of Swine breeders in the West: Until the fall of 1870 but little was known concerning this breed of hogs in the United States, but in England they have been known for over one hundred years. In 1767, at the First Manchester Agricultural Show, Manchester being in Lancashire, a hog of this breed was shown, taking the first prize in the class of White Swine. It is the representation of a hog of immense size, with tremendous limbs, very coarse, and by no means an animal that would be approved of by the judges of the present day. Short-Faced Lancashire White Breed.—This breed of swine may be known by the following characteristics: The shortness of the face from the eyes to the end of the snout; prick ears; small bones; a good coat of white hair; cubic in form, with broad back and broad hams, well let down. The skin, as well as the hair, is white, although an occasional one may be found having a few dark-blue spots on the skin, but never dark or black hairs. Large Lancashire White Breed Swine.—This variety of swine have large bones, are of great height and length, and are the largest breed of swine known. They are a true breed, which is proved by the greatest winners and most famous hogs being got by those who have won most prizes. Thus, Samson, Ranger, Victor, Great Western, Great Eastern, etc., etc., hogs that won the First Royal All England Prizes, are the sires and dams of the present winners, and the size and quality descend from generation to generation—the quality being improved by judicious selection. Lancashire Middle Breed White Swine.—This breed is one, which partakes of the quality of the small breed and the size of the large breed. Middle bred hogs are got by crossing large bred sows with small bred boars, but all attempts to attain the same results by reversing this operation, and putting large bred boars to small bred sows have proved failures. The largest of the middle bred sows are used to improve the large breed. Their characteristics are as follows: The small bred hog must have small bones; a short face; silky hair; fine, small, upright ears; a comparatively square form; must have good square hams, the most valuable part of the hog; must carry the meat near the ground; flat on the back; straight and cubic in form. Large Breeds.—Must be of large size; great length; flat back, with large square hams when fattened; must carry their width of back along over the hams; must have deep and tolerably straight sides, large feet and leg bones; hair short; may have a long face, but it had better be short, as they fatten better; may have a large, drooping ear, but, other qualities and size being equal, an upright, smaller ear preferred. They usually have a long, thick, strong tail; must be of great weight when fattened, and above all must be descended from a hog having the foregoing qualities, and, if a breeder, must produce them. They are short of hair, but still are hearty. A middle bred hog must have a short face, and all other good qualities of the small breed, except that they may be longer in proportion to their width; must have thicker legs and longer bones to carry the greater size; should be well haired, fattening to full form often causes the hair to temporarily fall off, which must be allowed for. As good a short rule as can be adopted to judge them by is as follows: The best middle bred hog should have the most possible of all the qualities of the small breed, with the length, and, in a measure, the larger bones of the large breed.

LANCEOLATE. Lance-shaped, oblong, and gradually tapering to the ends.

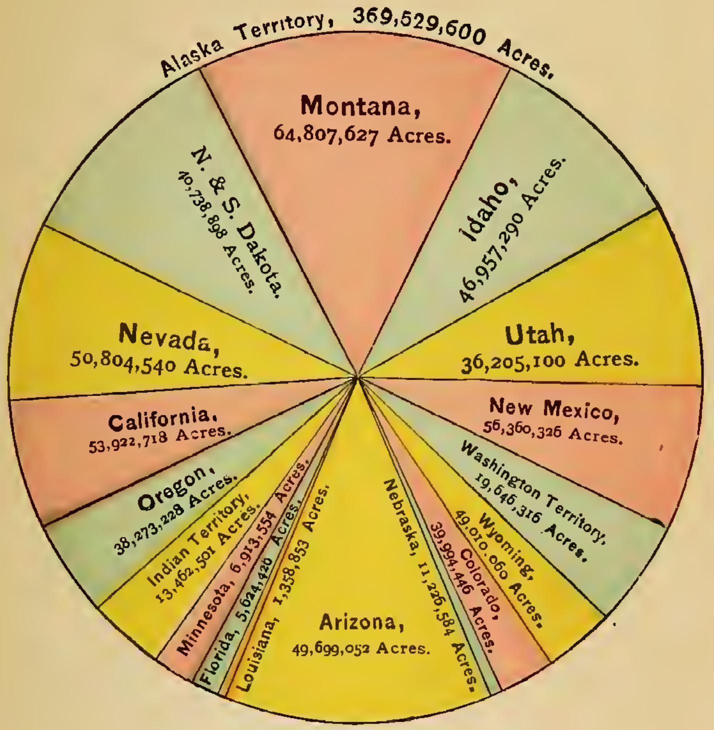
LAND. In agriculture, the bed, between two water furrows.

LANDED ESTATES AND FARMS. As a nation increases in wealth the acquirement of large landed estates seems to become a passion among the wealthy. In Great Britain, the accumulation of land by the wealthy has been carried to such an extent that the entire land of the country is held by less than 50,000 individuals in a population of over 30,000,000. The same rule holds good, though not to the same extent, in other European countries except in France, where the land is generally held in small areas. In the United States, within the last ten years, the same passion has taken root among a certain class of wealthy Americans, and bodies of land running from one thousand to hundreds of thousands of acres, are now held by individuals. Yet, from the fact, that in this country, we have no law of primogeniture, the estates are eventually subdivided and disintegrated. In England there are 32,342,000 acres of land. This vast area of land fifteen years ago, was owned by less than 44,000 proprietors. In Scotland there are 19,738,930 acres of land. It is owned by 4,000 proprietors. Within the last fifteen years these accumulations have steadily gone forward, and the accumulations have become greater and greater in individual hands. In France, the waste land in 1826 was one-twelfth of the whole surface, 10,000,000 acres; and since that time improvements have steadily been carried forward. In 1850 there were but 5,000,000 acres of waste land, and now there is scarcely an acre but has its money value, either in the crops it produces, in timber and brush wood, or in other valuable products. In many countries the pastoral lands form the chief wealth of the country; such are the steppes of Asia, the grazing regions of South Africa, Australia and South America, where herds may live the year round. Corresponding to these are the plains of the United States, extending from the Mexican boundary on the south, to the British possessions on the north, and from the twenty-first meridian of longitude west of Washington to the Pacific ocean, comprising an area of over 1,000,000,000 acres, which is covered with rich grasses, a considerable portion of it now occupied with fertile farms; the mountain ranges rich in timber, and with inexhaustible mines of both the precious and baser metals beneath the surface. In Colorado, Wyoming and mountainous Utah, the first cattle were shipped east from these mountain and valley ranges, and now vast herds are there raised, feeding winter and summer on the bunch, and other nutritious grasses that retain their substance even when dry. This country is bisected into nearly equal portions by the lofty and snowy range of Sierra Madre, or Mother of Mountains, of the old Spanish explorers. This mountain range, in its windings, measures fully fifteen hundred miles in length, and from its snow-covered tops a thousand streams take their rise and plentifully water its mountain slopes. It is here that the Rio Grande, the Red, the Arkansas,

OUR PUBLIC DOMAIN.

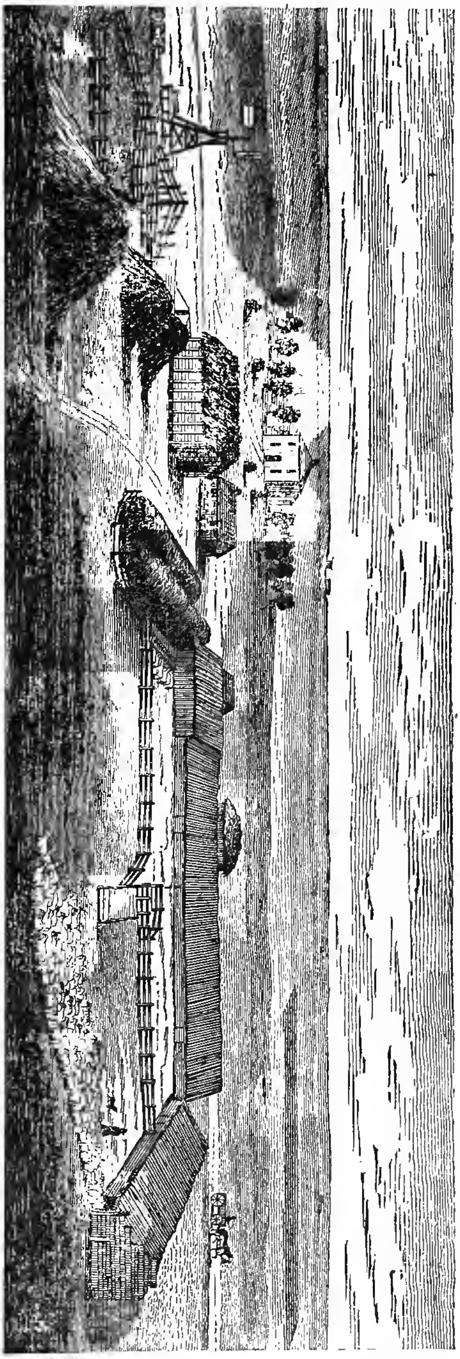
Unoccupied Lands and Where they Lie.

DECEMBER, 1890.



This makes, exclusive of Alaska, a total of 585,005,519 acres. On June 30th, 1882, the unoccupied public lands amounted to 1,814,793,938 acres; the decrease since that date having been, as will be seen, 1,239,788,419 acres. If this appropriation of the public domain should continue for only a short time longer, at anything like this rate, it would be speedily exhausted. But it must be further remembered that the lands taken up have, in all cases, been the most valuable, and that a large portion of those still available are uncultivable, or poor. However, a certain proportion of the unrightfully obtained railroad grant lands is to be soon restored to the public domain, and this restitution will increase the total of desirable land by many millions of acres.

the Plattes, the Yellowstone, and the Missouri on the east, and the Columbia, the Sacramento, the Humboldt, the Green, and the Colorado on the west, with their many tributaries, take their sources in the everlasting snows. The soil of the country is produced by the disintegration of the limestone, sandstone and granite ridges of this mountain range, and it is therefore, dry, gravelly, and porous, except on the border of the streams. Along the streams the soil is a dark mold, formed from the decomposition of the vegetation growing on the mountains. The grasses of the wide plains and valleys and the lower mountain sides are the bunch, buffalo, grama, mesquite, and in some valleys the blue-joint, red-top, and wild rye grass. The grasses grow and flourish up to the timber and snow line—to an altitude of 10,000 feet. In addition to the grasses, there is a great variety of sweet, tender, and aromatic herbage, upon which sheep and goats delight to browse. Of the artemisia there are twelve to fifteen varieties, of which the wild sage furnishes five or six. There are four or five varieties of sheep-sorrel; and of the wild pea-vine there is an extensive family. There are also many kinds of the wild dock and the balm. The climate of this region is much like that of Asia. The rain-fall is light, being about eight inches annually in the country west of the Missouri river and east of the Sierra Nevada Mountains; while the snow fall, at the altitude of 7,500 feet, is only two feet. The fall of snow at any one time is small, and never lies on the ground to afford sleighing or to cover the grasses. The rainy season is in May and June, and after these months the only rain that falls is from electrical showers. While the rain is falling in May and June, vegetation grows luxuriantly; but, when the rains cease, the grasses gradually dry on the ground, so that by the time the frosts come, in September, they have become perfectly cured uncut hay. The post surgeon at Fort Kearney, says of the country surrounding that post: The average temperature for the year 1868 was 52° Fahrenheit. Snow does not remain any length of time. The report from North Platte station, Union Pacific Railroad, states that the climate is healthful, and the extremes of temperature, on account of the dry and rarefied atmosphere, are well borne. The rain and snow fall are small. From Fort Sedgewick, Dr. Monroe, United States Army, reports: The mean temperature for 1869 was 50° Fahrenheit, rain-fall 8.9 inches, snow-fall 10.82 inches. The atmosphere is usually dry. The prevailing winds are from the west. From Fort D. A. Russell, near Cheyenne, at the base of the Rocky mountains, at an altitude of 6,100 feet, Dr. C. H. Alden, United States Army, reports: The mean temperature for the past two years, 1868 and 1869, has been 46.53° Fahrenheit; average rain-fall for the past two years, 6.25 inches. From Fort Laramie, Wyoming Territory, Dr. Schell, United States army, writes: The mean annual temperature is 50.6°. The climate is healthy, autumn and winter mild, summer dry and sultry, spring usually rainy. Dr. W. E. Waters reports from Fort Bridger, in the extreme western portion of Wyoming: The climate is temperate and salubrious the greater part of the year; the weather during the fall months is mild and delightful, excepting a few storms of short duration. During the months of May and June there is a greater rain-fall than in all the other months. The rain-fall for the last year amounted to 7.97 inches. Dr. F. L. Town, of Fort Shaw, Montana Territory, in latitude 47° 30′ north, writes: The climate of the Territory is exceedingly dry all the year round. The aggregate fall of rain and snow (melted) for the year 1868 was 10.14 inches.



A WESTERN RANCH.

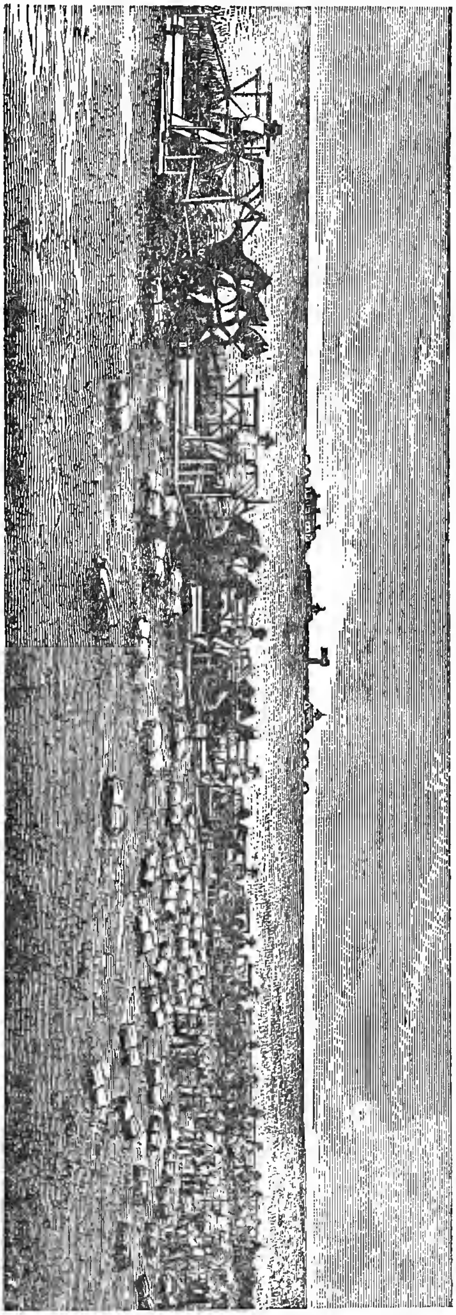
Snow rarely lies on the ground long after a storm. The mean temperature for 1869 was 47.35° Fahrenheit. This shows conclusively that the climate is uniformly dry, that the rain and snow-fall is small, as in the interior of other continents, where winter grazing has been generally common through all historic periods. The total area of land in the United States, as reported by the Land Commissioners, was estimated at 2,943,257 square miles, or 1,883,744,000 acres; or, if we include the Indian Territory, 3,010,277 square miles, equal to 1,926,636,800 acres. The following table will show, by States and Territories, the acres of cultivated and uncultivated farms in 1850 and 1860:

States and Territories.	Acres of improved land in farms.		Acres of unimproved land in farms.	
	1850.	1860.	1850.	1860.
Maine.	2,039.596	2,677,216	2,515.797	3,023,539
New Hampshire.	2,251 488	2,367,039	1,140,926	1,377,591
Vermont	2,601,409	2,758,443	1,524.413	1,402,396
Massachusetts	2,133.436	2,155,512	1,222,576	1,183,212
Rhode Island	356,487	339.884	197,451	189,814
Connecticut	1,768,178	1,830,808	615,701	673,457
New York	12,408,964	14,376,397	6,710,120	6,616,553
New Jersey	1,767,991	1,944,445	984,955	1,039,086
Pennsylvania.	8,628,619	10,463,306	6,294,728	6,548,847
Delaware	580,862	637,065	375,282	367,230
Maryland	2,797.905	3,002,269	1,836,445	1,833,306
Dist. Columbia	16,267	16,267	11,187	16,789
Virginia	10,360,135	11,435 954	15.792,176	19,578.946
North Carolina.	5,453,975	6,517.284	15,543.008	17.245,685
South Carolina.	4,072,651	4,572,060	12,145,049	11,623,860
Georgia	6,378,479	8,062,758	16,442,900	18,587,732
Florida	349,049	676,464	1.246,240	2,273.008
Alabama	4,435,614	8,462,987	7,702,067	12,687,913
Mississippi	3,444,358	5 150 008	7,046,061	11,703,556
Louisiana	1,590.025	2,734.901	3,399,018	6,765.879
Texas	643,976	2,649,207	10,852,363	20,486,990
Arkansas	781,530	1,933,036	1,816,684	7,609,938
Tennessee	5,175,173	6,897,974	13,808,849	13,457.960
Kentucky	5,968,270	7,644,217	10,981,478	11,519,059
Ohio	9,851,493	12 665,587	8,146,000	8,075,551
Michigan	1,929,110	3,419,861	2,454,780	3,511,581
Indiana	5,046,543	8,161,717	7,746,879	8,154,059
Illinois	6,039,545	13,251,473	6,997,867	7,993,557
Wiscoosin	1,045,499	3,746,036	1,931.159	4,153,134
Minnesota	5,035	554,397	23,846	2,222,734
Iowa	824,682	3,780,253	1,911,382	5,649,136
Missouri	2,938,425	6,246,871	6,794,245	13,737,939
Kansas	....	372,835	....	1,284,626
California	32,454	2,430,882	3,861,531	6,533,858
Oregon	132,857	895,375	299,951	5,316,817
Washington	....	....	....	300,897
Utah	16,333	16,333	30,518	58,898
New Mexico	166,201	166,201	124,370	1,177,055
Nebraska	....	....	....	501,723
Dakota	....	....	....	24,333

The older States have varied but little since. According to the report of the Commissioner of the General Land Office for 1878, the total area of the public domain was 1,814,772,648 acres, of which 724,311,447 acres had been surveyed, leaving 1,090,461,171 acres unsurveyed. Some of the unsurveyed lands are covered by inchoate titles that will inure to railway corporations and pre-emption settlers upon the completion of survey, but the great mass of these unsurveyed lands are, as yet, entirely uncovered by any private claims, and are consequently open to settlement. Of the above area of unsurveyed lands, 369,529,600 acres are in Alaska, of which a former Commissioner of the General Land Office, Mr. Joseph S. Wilson, estimated that about 20,000 square miles or 12,800,000 acres are fit for some kind of agricultural settlement; this is about half the area of Ohio. A large portion of the unsettled land west of the Mississippi river consists of broken mountain country and of arid alkali soil unfit for cultivation by any process now known. The Indian Territory, embracing 44,154,240 acres, is reserved for the occupancy of Indian tribes, and hence it is not open to white settlement. Making all deductions, it is safe to estimate that of the unsurveyed lands there remain 500 million acres suitable for profitable culture and uncovered by private title of any kind. The annexed table will show the area in acres, the acres surveyed, and the acres appropriated, in 1874, of those States and Territories containing public lands:

States and Territories.	Area in acres.	Acres surveyed.	Acres appropriated.
California	120,947,840	38,806,776	20,877,602
Dakota Territory	96,596.128	13,863,913	5,835,604
Montana Territory	92,016,640	6,784,481	5.179,821
New Mexico Territ'y	77,568,640	5,486,185	6.864,082
Arizona Territory	72.906,240	3,135,753	4,050,350
Nevada	71,737,600	8,198,194	4,669,383
Colorado	66,880,000	15,683, 86	4,303,329
Wyoming Territory.	62,645.068	4,748,841	3,480.281
Oregon	60,975,360	15,255,617	9,515.744
Idaho Territory	55,228,160	4,014,953	3,102,407
Utah Territory	54,065,042	5.984,792	5,515.086
Minnesota	53,459,840	35,897,912	19,516,340
Kansas	52,043,520	45,770,685	10.544,439
Nebraska	48,636,800	32,372,410	8 869,943
Washington Territ'y	44,796,160	10,190,046	3,556,907
Indian Territory	44,154.240	22,832,725	....
Missouri	41.284.000	41,284,000	40,549,368
Florida	37,931,520	29,345,870	20.643,611
Michigan	36,128,640	36,128,640	32,468.110
Illinois	35,462,400	35,462,400	35,462.400
Iowa	35,228,800	35,228,800	34,036 220
Wisconsin	34,511.360	34,511,360	26.118,729
Alabama	34,462,080	34,462.080	28.522.448
Arkansas	33,406,720	33,406,720	22,463.872
Mississippi	30,179,840	30,179,840	25,531,387
Louisiana	26,461,440	23.909.253	20,033.897
Ohio	25,576,960	25,576,960	25,576,950

Of the surveyed lands it is somewhat difficult to form anything like a satisfactory estimate. The public surveys have been completed in the States north of the Ohio river, in Alabama, Mississippi, and in all the States just west of the Mississippi river, except Minnesota. In Alabama there were 91,000 acres of United States land yet unoccupied and subject to entry in Crenshaw county, 85,000 in Monroe, 100,000 in Franklin, 46,000 in Conecuh, and smaller tracts in others. In Mississippi, Scott county reports 42,000 acres; Lauderdale, 40,000; and Winston, 30,000. In Florida, where 7,827,724 acres are still unsurveyed, Clay county reports 140,000 acres; Santa Rosa, 87,000; the southern counties embracing the Everglades, have been to a small extent appropriated by private parties, though large areas have been donated to the State as swamp lands. Lousiana has 1,229,396 acres yet unsurveyed. Our correspondent reports 130,000 acres in Bienville, 29,000 in Claiborne, and smaller tracts in other parishes. In Arkansas vast tracts of government land, all surveyed, are open to settlers; about half of Garland county, 309,000 acres in Van Buren, 100,000 in Pike, and large bodies in other counties. These Southern States probably still contain from fifteen to twenty million acres of United States land open to settlers under the land laws, by purchase, pre-emption, and homestead titles. North of the Ohio river the government title has been extinguished to all lands in Ohio, Indiana, and Illinois, except a few isolated small tracts of refuse land. In northern Michigan several counties still report vast bodies; Chippewa, 500,000 acres; Delta, 100,000; Alcona, 30,000, etc. Very large tracts are found in northern Wisconsin; Oconto and Lincoln counties are supposed to have upwards of a million acres; in the southern counties also large bodies are found unoccupied. In the absence of definite statistics it may be safe to estimate the amount of government land in these States uncovered by private titles at from five to seven million acres. West of the Mississippi river, Minnesota, Nebraska, and Colorado still embrace 67,884,579 acres of unsurveyed land, Iowa, Missouri, and Kansas having completed their surveys. The total amount of surveyed land in these six States is 230,104,921 acres. Of this area a very large amount has been donated to States and railway corporations, and a very large area taken by private claimants. It is not unreasonable, however, to estimate that about 100,000,000 acres, or one-third the area of these States, remains at the disposal of the general government. In the Territories of Dakota, Wyoming, New Mexico, Utah, Idaho, and Montana, embracing an area of 438,119.680 acres, about six-sevenths, or 373,748,118 acres, remain unsurveyed, but of this area a considerable amount will inure to railway corporations as soon as the surveys are completed. Probably 250,000,000 acres of land suited to agricultural settement yet remain at the disposal of the government. On the Pacific slope three States, California, Oregon, and Nevada, and two Territories, Arizona and Washington, covering in all 351,408,000 acres, about five-sevenths, or 250,290,564 acres, remain unsurveyed. Individual or corporate title has attached to an area about equal to the surveyed lands, but of the remainder a large proportion is covered with mountain ranges, or with an arid climate, rendering it unfit for any kind of farming except, perhaps, sheep farming. In regard to lands at the disposal of the different States, the information is less general or specific. None of our correspondents found any such lands available for private settlement in the New England or Middle States. Craig county, Virginia, reports 2,000 acres. State lands undisposed of are also reported in several counties of North Carolina, viz, Pamlico, Hyde, Graham, Bladen, Caldwell, Alleghany, Camden, Henderson, Tyrrel, Wilkes, and Montgomery. Similar reports from Beaufort, Colleton and Clarendon, in South Carolina. Camden, Georgia, reports 60,000 acres. All the Gulf States report considerable bodies of State land disposable in different counties. Texas on her accession to the Union stipulated for the possession of her own public lands, and has consequently an immense domain open to settlement. The other Gulf States were all erected out of the public domain, and have been endowed by the general government with various land grants under the educational, swamp land, and other laws. Of the Southern inland States, only Arkansas is a public land State, and hence has had numerous grants from the general government, of which a considerable portion remains unsold. In Tennessee, where the unoccupied lands has been ceded to the Union by North Carolina, the lands were found so covered by contradictory private claims that the general government ceded them to the State of Tennessee. From the returns we conclude that the mass of these lands have passed into private ownership, as only two counties, Fentress and Meigs, note any remnant within their borders. West Virginia and Kentucky report no lands of this character. In Ohio no State land is reported; in Indiana our correspondent, in Jasper county, reports 40,000 acres. In northern Michigan

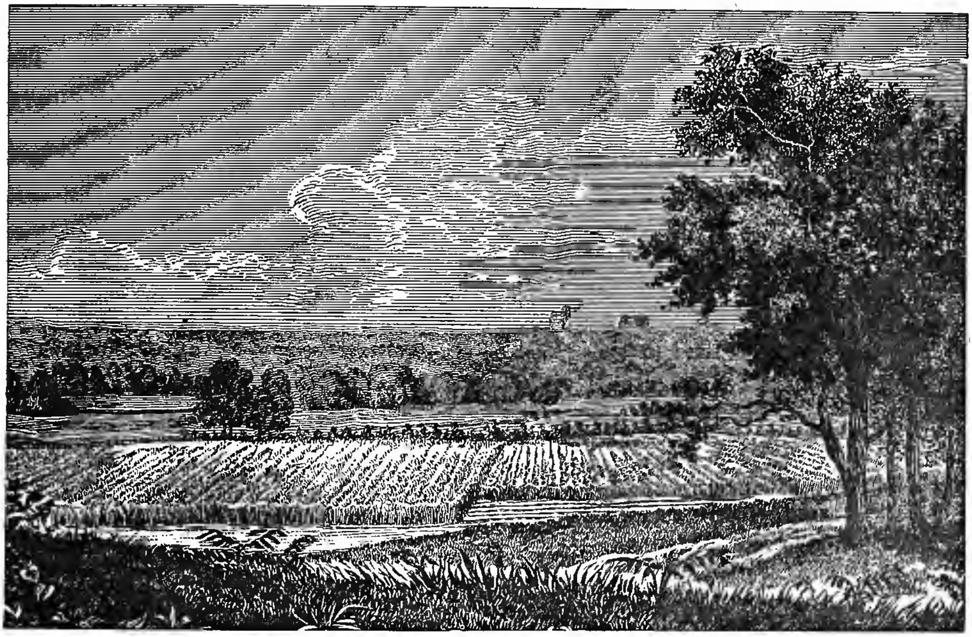


HARVESTING IN THE FAR NORTHWEST.

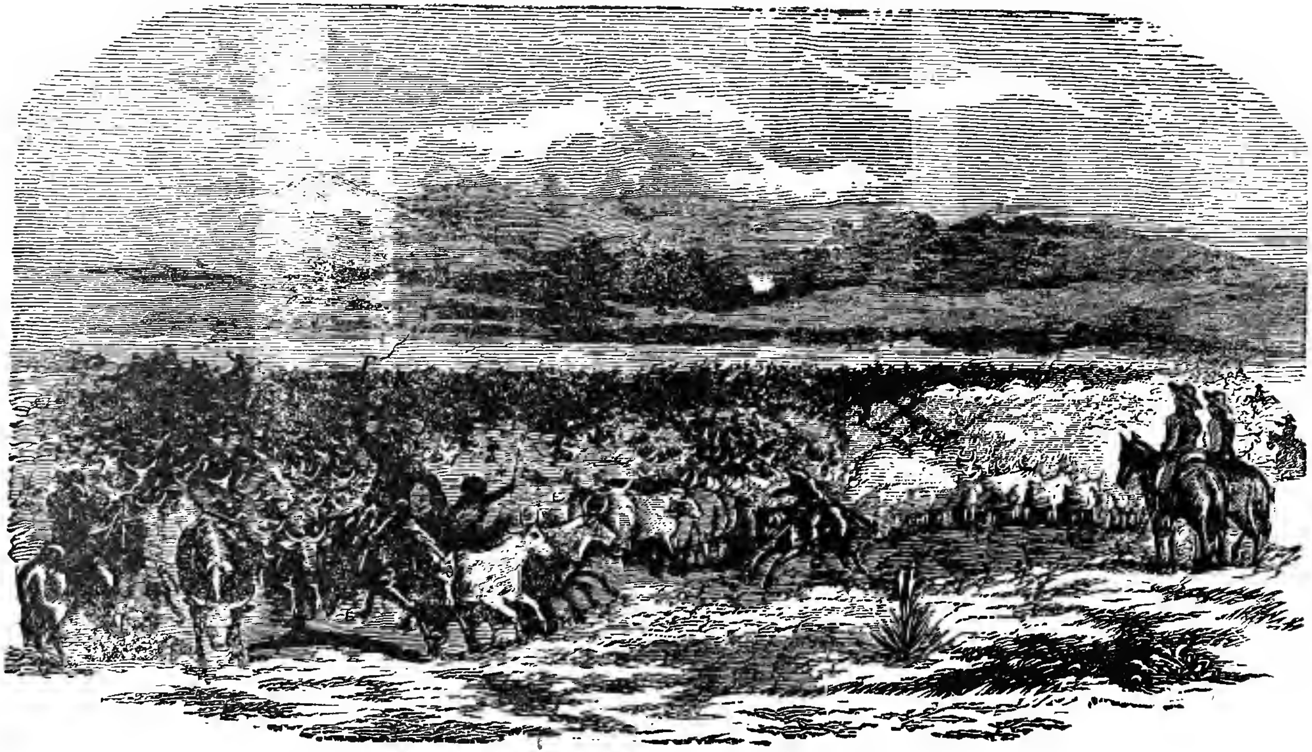
large bodies of State lands are yet undisposed of. Wisconsin has largely disposed of her lands, yet several counties report from 10,000 to 20,000 acres. Minnesota has a large amount of State land undisposed of; only half the county of Crow Wing has passed into private ownership. Iowa has mostly disposed of her State lands. Considerable tracts are scattered through Missouri; but Kansas, Nebraska, and Colorado present very large areas. The Territories have received but small endowments as yet, and consequently have but little to offer. On the Pacific coast numerous tracts of State land await disposal. Of lands granted for rail and wagon road construction the total area is 198,165,794 acres, of which 59,308,581 were granted to fourteen States, viz, Illinois, Mississippi, Alabama, Florida, Louisiana, Arkansas, Missouri, Iowa, Michigan, Wisconsin, Minnesota, Kansas, California, and Oregon, in behalf of railways chartered by them. To the corporations commonly known as the Pacific roads were granted about 135,000,000 acres. The locality of many of the later donations can not be determined till the public surveys along their lines shall have been completed. The endowments vary in amount. The earlier roads, such as the Illinois Central, were allowed the odd numbered sections within six miles on either side of the road, and selections of odd numbered sections between that limit and fifteen miles to replace sections within six miles to which prior rights had attached. In some of the later grants the limits of the original and reserve tracts were increased to twenty and thirty miles respectively. Some of these grants have lapsed through failure of the grantees to comply with the conditions required by law. Of the above aggregate, 3,857;213 acres were granted to three States, viz, Wisconsin, Michigan, and Oregon, for military and wagon roads. Of unoccupied lands belonging to individuals, vast areas are reported in all sections of the Union. In the mountain and forest regions of the older States, for instance, we are informed that from half to three-fourths of whole counties are held, without occupation or cultivation of any kind, by private parties. Much of this represents valuable mineral lands, and other woodlands largely on mountain slopes. Such lands are to a small extent available for agriculture. There is no doubt that in a great many instances men have more real estate than they can profitably manage, and that many eligible farm tracts are available to purchasers from this source. Yet it is human nature to hold on to what is acquired as long as possible, and it must be confessed that the management of the great wheat growing farms in the Northwest and the great cattle and sheep ranches on the plains, have been most admirable, so far as a good interest on the capital invested is concerned. As the country grows older, these investments will continue to pay less and less, until at length it will become imperatively necessary that these immense estates be subdivided into small estates. As showing the animus exhibited in acquiring these large estates, we have shown, by illustrations, a stock ranch on the plains, an actual harvest scene in the Northwest, a plantation scene in Texas, and also a round-up of cattle on the plains. The prices of farm lands, both cleared and timbered, were made subject of inquiry in several investigations. The following table shows the results of those inquiries for 1880. The first column gives the States mentioned, except Rhode Island, from which there is no report; the second column the average value per acre of cleared land in 1880; the third column the average value per acre of timbered land, and the last column the average increase in value of both classes in one year:

States.	Average value cleared lands.	Average value timbered lands.	Average increase both classes.
			Per cent.
Maine	$12 87	$12 66	10
New Hampshire	15 00	32 00	10
Vermont	15 28	17 73	6
Massachusetts	85 00	43 25	8
Rhode Island	......	......	......
Connecticut	29 00	21 50	7
New York	58 48	40 88	4.7
New Jersey	82 42	56 82	5.2
Pennsylvania	45 75	29 70	7
Delaware	19 00	15 00	7.5
Maryland	24 65	35 50	6.3
Virginia	9 42	7 48	1.4
North Carolina	9 77	5 53	6
South Carolina	8 64	6 24	9
Georgia	6 93	5 45	10
Florida	9 48	3 03	28
Alabama	6 53	4 08	9
Mississippi	7 88	3 78	9
Lonisiana	14 36	3 53	9
Texas	8 98	4 00	4.8
Arkansas	11 78	3 48	7.3
Tennessee	13 00	7 28	8.7
West Virginia	21 05	9 39	8
Kentucky	18 86	12 82	8.2
Ohio	47 53	41 87	8.5
Michigan	34 39	20 27	8
Indiana	30 46	26 90	8.7
Illinois	33 03	23 68	11
Wisconsin	26 07	19 55	7
Minnesota	14 45	12 25	5
Iowa	27 36	39 36	7.5
Missouri	14 52	8 25	12.5
Kansas	11 82	19 12	10.3
Nebraska	8 93	25 85	15.3
California	27 16	8 55	3.2
Oregon	21 71	4 50	2.6

It will be observed that every State shows an increased average value. A few counties report no change and still fewer a decline. The average for the whole country is eight per cent. increase. New England reports an increase of eight per cent. Timber lands here show a tendency to advance in relative value, showing a growing scarcity of this kind of lands. In New Hampshire and Vermont the average value of timbered lands exceeds that of cleared lands, while in Maine there is comparatively little difference. In Alabama, Mississippi and Louisiana wood lands are comparatively lower. The proportion of urban to rural property and population is so much greater, that the value of land depends more upon its market crops. In the Middle States the average value of both classes of land has advanced five per cent. The total area here is more than double that of New England. The advance in prices is mostly caused by the extension of mining and manufacturing and is felt more strongly near the centers of those branches of industry. Timber land also commands a higher price. In the oil regions quite an area supposed to be rich in petroleum is held by speculators for higher prices. The South Atlantic States have advanced their land values six per cent. Many counties report a very considerable appreciation from various causes. The increase in tobacco culture, the abundance and high price of the last cotton crop, manufacturing and mining enterprises, etc., are mentioned as among the causes of this improvement. The Gulf States estimate a rise of eight per cent. The Florida figures, twenty-eight per cent., are believed to be excessive, but the small area of farm land compared with other States in this section, renders this excess of little importance in the general estimate. On the other hand, the estimate of Texas, 4.8 per cent., is evidently too low. In Florida, vast areas of timber land are just coming into market, and the special value of the land depends not upon its adaptability for agriculture as for the timber to be cut off it. In all these States are large amounts of public lands available for settlement and purchase from the government. In the western counties the exodus of African laborers has caused some reaction and caused some lands to be thrown upon the market. The yellow fever also had its reactive influence. In several counties, a rapid denudation of timber lands is noted. The Southern inland States claim an improvement of nine per cent. In Arkansas the rapid increase of population and settlement will account for this improvement. In Tennessee and West Virginia there has been a considerable increase in the mining population and in mining enterprise. The removal of colored laborers to Kansas has caused an influx of white labor. In these and in other Southern States it is noted that the freedmen are becoming land-owners to an extent hitherto unexpected. North of the Ohio the enhancement in the value of lands was about nine per cent. An increased demand for real estate has sprung up under the operation of several causes. Mineral and manufacturing enterprise are advancing in different parts of this region, the latter at giant strides; but the advance in prices of farm lands in this region is evidently due to the immense crops of 1879. Several correspondents complain that timber land is becoming scarce, yet in all these States cleared land bears a higher average price. West of the Mississippi river farm lands increased ten per cent. in value. In the prairie States—Iowa, Kansas, and Nebraska—timber land bears a higher price than cleared land, and in these States a very considerable effort has been made to plant lands in timber. The rapid increase in population, together with the extension of manufacturing enterprise in these States, will account for the increase in farm values. The Pacific States show but three per cent. increase. In relation to the public domain of the United States, and the yearly surveys, in spite of the prodigal manner in which they have been given away in aid of public and private enterprises, there still remains a large body, surveyed and unsurveyed, to be disposed of. This is exclusive of Alaska, which is not supposed to contain much land suitable for cultivation. The public lands surveyed during the year 1880 amounted to 15,699,253 acres, making, with previous surveys, a total of 752,557,195 acres in all surveyed, and leaving an estimated area of 1,062,231,727 yet to be surveyed. The annual survey is about double the number annually disposed of. How much really arable lands remain for the settler to take up can not, of course, be determined from the land office reports, nor do the best authorities agree as to the proportion of good land to the whole domain. In respect to the amount of area susceptible of cultivation in the different countries of Europe nature has been very diverse. Inaccessible and arid mountains, and lands subject to overflow of the sea, constitute the greater portion of lands classed as not arable. The



A TEXAS FARM.



A CATTLE ROUND-UP.

percentage of lands not arable is greatest in Norway, being seventy-two per cent. of the whole; next comes Sweden, then Portugal, while Bavaria and Würtemberg have the least proportion not susceptible of cultivation, being less than two per cent. Great Britain has twenty-eight per cent. not susceptible of cultivation, Ireland thirteen per cent., and France only nine per cent. The amount of land devoted to cereal crops and to fallow and pasture also differs greatly, according to the habits and traditions of the inhabitants. Belgium has the largest proportion of land in cultivation, having fifty-nine per cent.; France has fifty-three per cent., and Great Britain thirty-nine. In the United States no effort has been made to find the area susceptible of cultivation. It is, however, one of the most favored of any country on earth, considering its vast area. In the prairie country, for instance, there is almost none of the land but what may be cultivated. (See Supplement for additional information).

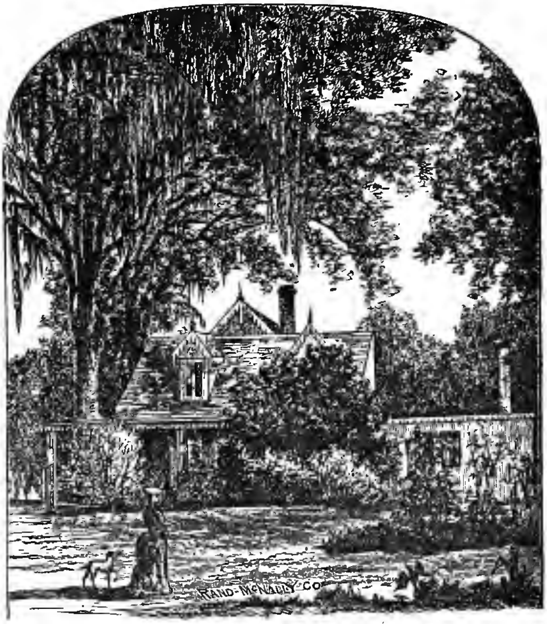
LANDSCAPE GARDENING. Landscape gardening is one of the departments of Horticulture, by which the effect of a natural scenery is heightened by art, or by which a monotonous area is rendered beautiful, by means of walks, drives, lakes, bridges, rock-work, and the planting of trees, shrubs, and flowers. In fact, in its broad sense, it is high art, in which but few professionals ever arrive at high eminence. So far as the present work is concerned, it will not be necessary to go into the minutia of details. To point out some means by which the farmer may beautify his home, and give illustrations of nature's, and of artificial work, will be sufficient Many farmers seem to be imbued with the idea, that time and money spent in beautifying the grounds about the home is time and money thrown away, and yet there is no means that may be employed that will give so much present satisfaction, or that will more enhance the value of a property if it is to be sold. In this they are not altogether to blame. They bave been taught to believe that it could only be accomplished at a large outlay of money, and through the labor of a professional gardener. Nothing, however, could be more fallacious. It is not merely artificial surroundings that they are to create, but to take advantage of the natural beauties of a home and heighten these by bringing the grass into a close and smooth sward, to lay out and build walks and drives, and so arrange the planting of the whole that it may be partially shaded with handsome trees, and to shut out offensive objects by closer planting. In fact the whole farm is to be considered. If there is an unsightly knoll near crown it with deciduous and evergreen trees. If there is a depression, some parts of which are marshy, form a lake, and from it a small stream to carry away the outflow, taking advantage of any facility that may offer to drain the balance. Plant the edges of the pond with weeping or other willows, and thus three important objects are subserved, drainage, water, and shade. In nine cases out of ten the drained land will pay the cost of the whole. If there is a meandering water course running through a valley, clear the banks, leaving clumps of elms, maples, and lindens at the bends here and there Cover the banks with a firm sward of grass, and here again three objects are attained: superior pasturage, available water, and shade. In time the groups of timber will grow into trees, when they may be thinned and the surplus sold. There should be woodland on every farm, and if one can take advantage of land otherwise of little value for the planting, two objects again are attained: a provision of timber for the future, and a landscape effect that will be pleasant to the eye. In all this do not seek the picturesque, it is only here and there a place that can be heightened by picturesque planting, and these situations, picturesque in themselves, as for instance where there is a waterfall or rugged scenery. Sylvan beauty is what is wanted on the farm, and in no country in the world is the ground work more carefully laid by nature than in the West, where we have undulating prairie. There are but few farms where a permanent thread of water may not be supplied by artificial drainage intelligently conducted, and what is more beautiful than the soft haze lying about distant bits of woodland in the spring. The cool, inviting shade in summer, and the gorgeous splendor of the autumn when the maples are blazing with their many tints, while the other trees tone down their beauty with their more sober hues. It is the home grounds, however, that require the nicest attention. Here there should be plenty of room. A five acre lot is none too much for the farmer's home, for none can better afford it than he, and here it is grass and trees that beautify. Plenty of grass and only trees enough to shade it here and there. This may be partitioned off with light wire fences, to afford pasturage to sheep, calves and colts, or the grass may be mown so it need not be lost. If the ground be somewhat broken plant the knolls with clumps of trees just so as to

SOUTHERN FOREST SCENE.

break the view but not to shut out the vista beyond. Do not have too many roads and walks, these cost money, for they should be well made, and at least have the appearance of being made for use. Above all, never make the mistake of setting a pretentious mansion down on the prairie, with nothing about it but rough fences and rank herbage. The owner of a fine house without anything about it to tone down its glaring exterior, has made one of the most comfortless mistakes possible. A cottage, however humble, shaded by trees and with its vine-clad porch, with a winding path, gladdened with a few flowers, leading to it, is far more beautiful as it is far more homelike. Other things being equal, the farm with its pretty cottage and comfortable barns, protected by wind-breaks, and enlivened here and there with clumps of trees, will bring far more money, than the other with its barn-like mansion and its bleak surroundings. How this will look may be seen in the cut of a Southern Homestead on page 553. Mr. McWorter, one of the most observing and practically scientific horticulturists in the West has given the following ideas on making a homestead. They will well repay perusal. He says: Not to dwell at length on the various mistakes most commonly made in homestead arrangements, it may be briefly stated people are generally too stingy of the little bit of ground around the house; they allow no ground for shady lawns or homestead scenery; they fence themselves up in a little narrow door-yard, and then to save steps in doing chores they get the barn and its numerous appendages closely and conspicuously located, if not exactly in front of the house, at least so as to break the view to the road in a side direction. In short, the arrangements for the comfort, convenience and pleasure of cattle, hogs, chickens and children, are too closely mixed and commingled together. Even people who are anxious to have everything very nice, conceive of no way only the old, stiff, rectangular square rule plans for every thing—every thing is brought to straight lines and square corners—fences all straight, gate exactly in front, a straight walk to the front door, shade trees arranged in exact military order. Such grounds present no pleasing variety—nothing but the tiresome sameness of straight lines and rectangular forms. It is difficult to give any very definite rules for homestead arrangements, because scarcely any two situations are exactly alike. But, to bring the matter to your minds, we will suppose you are about to prepare for yourself a country home. You are inspired with the beauties of nature—you have listened to the music of the pines; and nature's picturesque scenery and flowing outlines have nearly expelled the old rectangular, iron square plans all out of your mind. You first choose your building site. You do not choose the most level portion of your farm; because for your building sites, groves, orchards, and general homestead scenery, you prefer grounds somewhat rolling; and for farming purposes you prefer the level lands. You choose a site for your house on a rising swell of ground, some ten or twelve rods from the road. You want room in front of your house for some breadth of grassy lawn, and some pleasing diversity of landscape scenery. You next decide on a spot for your barn, back of your house, and not too near, because you want room back of your house for garden and fruit-yard; for you know it is in bad taste to have a fenced-up kitchen garden next to the road. Having chosen the place for your barn and feed-lots off back of the house, you want a lane from these to the public highway; but you do not want this lane to infringe on the grounds of your house-yard, and you give this lane a graceful curve around your buildings. You border this lane with large trees—it gives a rich expression to your homestead and furnishes grateful shade. You plant trees of large growth back of your house, that will rise above the house and partially screen the barn and its appendages from view. You do not commit the blunder of planting all your evergreens exactly in front of the house; because you know, though they might look well enough there at first, they will, in time, grow to broad proportions, and even darken the light of your windows, and nearly hide your house from view. You group the evergreens mostly off in side directions, to the right and left; only allowing a few of symmetrical form and smaller growth on the grounds in front. You plant perhaps a few trees of large growth at the extreme outer border of your grounds, along the road. You avoid getting your front grounds too much filled up with low shrubbery; for you prefer that your front views shall consist mostly, of a clean, grassy lawn, with only

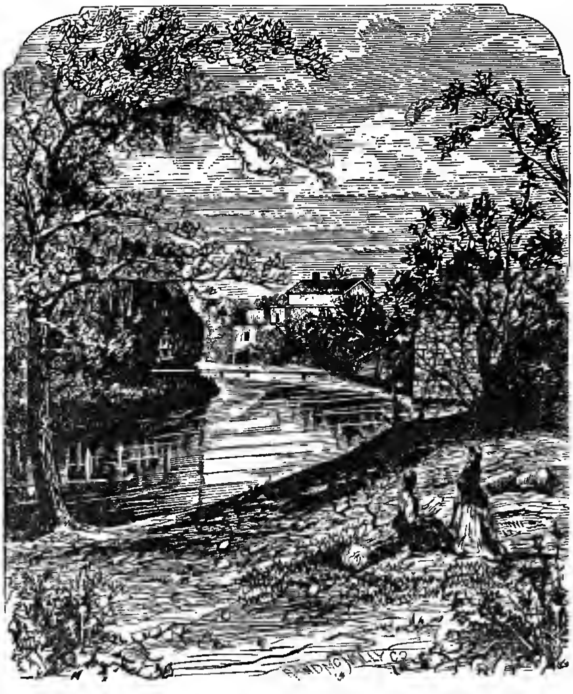
NORTHERN FOREST SCENE.

a few scattering trees to afford a pleasing play of sunshine and shadow. In short, you desire to have your largest trees back of your house, and breaking round in irregular groups toward the road, with only scattering trees in front. When your trees have grown up, your house, when viewed from the road, will appear to stand back in a kind of bay, partially encircled with a rich background of sylvan scenery, and having a breadth of green lawn in front. It is a very common error to plant too many trees in front, and not enough back of the house, and off at the wings. If a natural grove of young timber should be on the ground you have selected for your homestead, you will consider this very fortunate. The most charming situations are such as are already adorned with a growth of young timber. You will make such improvements on what nature has supplied at your hands as good taste and landscape effect will suggest. If you can preserve a natural grove of some extent, contiguous to your building ground, you will consider yourself especially favored. Nothing could add more to the sylvan attractions of a homestead. A country that is divested of its natural groves is bereft of its richest garlands of beauty. In planting trees and laying out grounds you will imitate nature's rounded turns and flowing outlines, so as to make groups of evergreens and masses of shade trees present a scenery of wild diversity. The aspect of your situation, or make of ground, will suggest natural curves or rounded turns to the outside boundary of your grounds. You will determine on the place for your entrance gate—not exactly in front of the house, but off in a side direction, so as to afford a richer view of the architectural forms of the house, and also to afford more changing views in the scenery of your grounds. Perhaps a gate for foot men will enter your grounds, in a side direction, from the one side, and the carriage gate off at the other. Your carriage-drive may either pass by a graceful curve in front of your house, and thence around your house; and off back to the barn, or (what is better) it may curve up near the house, and then wind its way toward the barn. Your walks, also, should take such easy turns or windings as the make of your ground or groups of trees will suggest. There should always be some seeming necessity for any or all turns in your walks. It is often proper to plant groups of trees to occasion a necessity for such turns in a walk or carriage-drive. Fences are obstructions in landscape scenery, and should only be built where absolutely necessary. Where a fence is indispensable, as along the public highway, it should be such as will obstruct the view as little as possible. If swine are excluded from the public highways, (as they should be in every civilized community,) fences may be constructed in good taste, that will be very little obstruction to landscape views. Out door-yard fences should be no higher than necessary—if a picket fence, let it be of square pickets, and as wide apart as security will permit. Do not paint your fences white. It is from a want of due reflection that people so often commit the error of painting their boundary fences white. A glaring white picket fence should never be placed in front of a beautiful landscape. The ostentatious white fence stands there in self-display, and attracts all attention from the landscape scenery beyond the fence. Let the fence be painted in some color that will harmonize with the bark of the surrounding trees, such as a sober drab, or the softer shades of brown. For objects of ornament, that stand back in some shady portion of the grounds, such as a pretty summer house, for a small building, partially screened by trees, or if a low cottage, white is not inappropriate for the dwelling itself; but for buildings of any considerable architectural proportions, other shades of color are preferred. Having thus rapidly presented some general principles in the arrangement of homestead scenery, we will briefly add a few suggestions on the management of grounds. In commencing the work of preparing a homestead on wholly naked ground, it is advisable to first plow and harrow the entire grounds. Your whole plan is next laid out and staked off. Your trees are planted by experienced workmen. Knowing the importance of giving your trees a vigorous growth on the start, you decide to cultivate the whole ground for a few years. You perhaps appropriate the more open portions to some low, hoed crops. A good, steady single horse and careful driver may be employed in the work of cultivation. After two or three years of this treatment, your trees get a luxuriant start and begin to present a pleasing aspect; and you finally prepare your grounds for seeding. This, in favorable seasons, should be done in August, so that if the August seeding is not a success, another sowing or seeding can be made very early in the spring. It is not very important what kind of grass seed is used, provided some blue grass seed is mixed with it—the blue grass will ultimately occupy the ground. In preparing grounds for seeding,



A SOUTHERN HOMESTEAD.

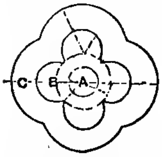
no labor should be spared in getting the surface perfectly even. After your grounds are seeded, it may be necessary to nurse the growth of some of your favorite trees by mulching, or by surrounding them with circular flower beds. You will not neglect the frequent and timely use of the lawn mower. What can be more charming than an expanse of closely mown lawn, enlivened by the lights and shadows of sylvan scenery? Your walks, also, must be kept free from weeds. A few of your evergreens most contiguous to the house may be kept trimmed in neat symmetrical forms; but those in more remote portions of your grounds should be allowed to assume a free growth and natural proportions. As illustrating natural scenery the cuts will show, first, a Southern forest scene, second, a northern forest scene. As illustrating great natural beauty, when water forms the principal feature, the illustration showing islands in the Mississippi will suffice. From the fact that it would occupy too much space to go into the details of landscape work from a working standpoint, and from the added fact, that no two places should be treated alike, we leave these suggestions as they are; but as a means of educating the eye to purely artificial work, so that when nature's effects have been heightened by art, and to natural picturesqueness, and also to sylvan landscapes, we have interspersed through this article landscapes which explain themselves. A few words as to the trees for planting will not be out of place. The barns and other farm buildings should be well protected, especially in prairie regions. Strong winds require strong trees, and cold winters warm shelter. Oaks, maples and elms, among deciduous trees and the Norway Spruce, white pine and firs, among evergreens, will be proper. Cottonwood, and other soft wooded trees may be allowed for a time while other trees are growing; but for permanent planting, they give a cheapening—not to say penny-wise—appearance, and where they are allowed to tangle with and overgrow better trees, a slovenly, not to say shiftless, appearance, while the other class express strength, sturdiness, independence and retirement. The common mistake made in new places is too thick planting, and especially in negligence in thinning. There is, however, no objection to rather thick planting of young trees but be sure you thin before there is even an appearance of crowding. Among the most beautiful of deciduous trees is the hard maple on suitable soil. On well drained prairie soil, although rather slow at first, it will clothe itself in the most luxurious foliage, and grow more and more beautiful year by year. The red or swamp maple, on moister soil, is handsome in summer and magnificent in autumn. A weeping willow is always beautiful in a valley or near water, and next to it the black willow. The golden willow is also beautiful in early spring, looking like a light green cloud in the distance. The elm is always beautiful and assumes so many graceful and pendent forms when planted singly that it should not be neglected. The Linden (basswood) is among the most beautiful of trees in summer where it has plenty of room to spread. It is on the whole a cleanly tree, handsome in its bloom at midsummer, and its broad leaves are somewhat tropical in appearance. Among shrubs for ornament the planter must be guided by circumstances. Small flowering shrubs may be interspersed about the lawn and herbaceous perennials may form center pieces for beds of flowers, or be placed nearer the house. In all cases when the planter may be in doubt, if practical descriptive text books be not at hand, the nearest intelligent nurseryman should be consulted. Nevertheless, the intelligence of the female portion of the household may here be generally relied on to guide correctly, in the arrangements and care of beds. So also their taste will be generally correct as to the proper planting of trees, shrubs, curves of walks and drives. In regard to the planting of trees and shrubs avoid straight lines. A good plan in the setting of trees and groups, is to provide a tall stake that may be easily seen from a considerable distance, and the requisite number of smaller stakes. Let the assistant be sent upon the ground to be planted to hold the stake, while the director stations himself from the point of view, as the porch of the house, etc.; direct the stakes to be set, so no two of them will come in line, at least not near together. Once they are fixed from the principal point of view, proceed to another principal point, and if there is a glaring defect, as seen from thence, have it rectified by moving the offending stake to another position that will not interfere with the view from the first point. Thus you may get your planting so it will easily harmonize as a whole,



NORTHERN HOMESTEAD.

and it will have been accomplished at a minimum outlay of time. In preparing your grounds, you have the satisfaction of having not only accomplished a work not generally supposed possible for farmers, but of having illustrated that it is not difficult. That it only requires a little thought and the display of original ingenuity. Neither of these are really difficult to him who should be as observant of what is going on about him in nature and art as the farmer. Because one labors with his hands it is no sign that he may not be an artist. In fact the inspiration of art seldom comes unsought or without thought. In conclusion we also present several forms of beds carefully prepared by Mr. H. DeVry, Assistant Superintendent of Lincoln Park, Chicago, from the more simple to those somewhat intricate with a list of plants proper for planting therein. The taste of the female portion of the family, however, may be relied on to make these beautiful with other flowers, annual, biennial, and perennial. The idea being to so blend color, form and size that the whole shall make a harmonious picture.

I



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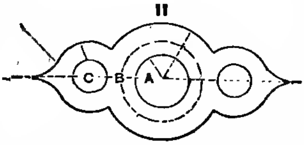
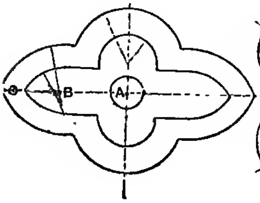


I.—A. Ageratum, dwarf, blue. B. Geranium, Wonderfu', scarlet. C. Coleus, Buttercup. The border, Alternanthera amœna.

II.—A. Coleus, la Nigra. B. White or pink Geraniums. C. Coleus, South Park Gem. The border, Achyranthus Lindenii.

III



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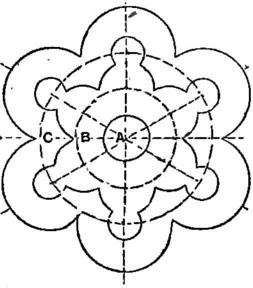
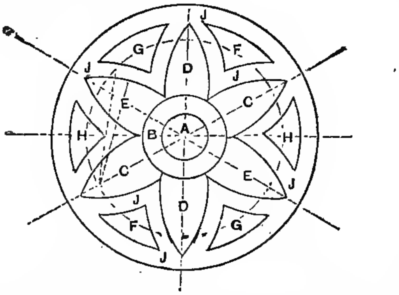


III.—A. Coleus, Crown Jewel. B. Geranium, Mme. Thibout. C. Blue and white Verbenas, mixed. The border, Alternanthera amœna.

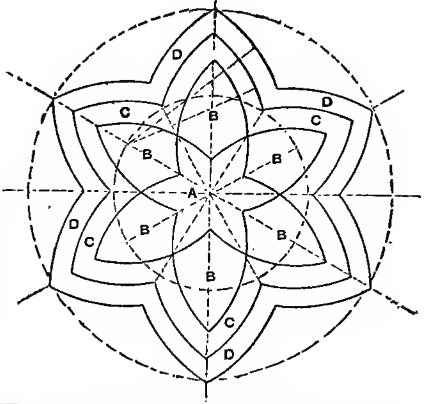
IV.—A. Scarlet Geranium B. Coleus, Mrs. Kirkpatrick. C. Achyranthus Vershaffeltii. The border, Cineraria Maritima.

V



V.—A. Ageratum, blue. B. Geranium, Wonderful, scarlet. C. D. E. Coleus, Vershaffeltii. F. Geranium, Mountain of Snow. G. Geranium, Earl Roslin. H. Blue Verbenas. J. Coleus, Park Gem. The border, Achyranthus Lindenii.

VI



VI.—A. Coleus, Mary Stuart or C. Rubra. B. Coleus, Park Gem. C. Coleus, Versicolor. D. Coleus, Puck. The border, Gnaphalium lanatum.

Under the articles Forestry, Gardening, Horticulture and Lawn, will be found other valuable information relative to the subject of Landscape Gardening

LANIARIES. *Dentes laniarii.* Conical teeth at the sides of the jaws, next the incisors.

LARCH. *Larix.* A class of trees having the general characteristics of the Coniferæ, except in the loss of the evergreen character, the family being strictly deciduous. When raised from seed the young plants hold their leaves for two, sometimes three years, and thereafter become deciduous, dropping their leaves and remaining bare during the winter. The larches, however, are treated precisely like evergreens, are subject to the same rules in transplanting, and in the effects to be produced upon the landscape. The species are few. The American Black Larch and the European Larch will serve as the types of the species. The European Larch for all purposes of ornament and excellence is the variety now generally planted. The wood is firm, very lasting, of tolerably quick growth, and has the peculiar quality of resisting fire. The tree is handsome in its drooping foliage and one of the most picturesque of trees in age, being especially adapted to planting on promontories, rocky places, gorges, etc. The best situation for the larch is sound land where the roots will not be drowned in winter nor suffer with drought in summer. The whole family are natives of cold climates and mountainous districts of Europe, Asia, and America. When planted in proper situations, the larch is a fast growing tree, but if transplanted should be done early in the spring, since the buds are apt to start with the first few warm days. The best way to handle larch is to transplant in the fall after the leaves have dropped, and protect the first winter with mulch and staking. Besides the European and American Larch, the Dahurian Larch may be mentioned, growing well up into the colder regions of Siberia. It seems nearly allied, according to the description of it by European writers, with the European Larch. In the colder regions of Siberia, it is a mere shrub, but further south becomes a large tree, with irregular, twisted, drooping branches. The Sikkim Larch, a native of Bhotan, Sikkim, and Nepal, an inelegant, sprawling branched tree, says Dr. Hooker, with the branches standing out awkwardly, and often drooping suddenly. In the autumn, the foliage is said to change to a bright red, forming a fine contrast to other trees. In the Altai mountains, of Siberia, is found the Altaian Larch, similar to the common larch, but with smaller cones, a strong growing tree, luxuriant, with large leaves and pendulous habits. The Western Larch (*Larix occidentalis*) found on the western slopes of the Rocky mountains, and thence toward Oregon. That the larch is a valuable tree for planting upon the soils we have described there is no doubt. That it is altogether unsuited to that class of prairie soils that are light and fluffy and subject to be wet in the winter and spring, is quite as evident. The evidence in regard to the success of planting on the western plains is conflicting, but the weight of testimony so far would seem to be that it is a valuable tree for planting.

EUROPEAN LARCH.

LARD. The leaf, intestinal and other fat of swine when tried into oil. It is one of the most important products next to the meat, and forms a very considerable portion of the carcase. The average ranging about thirty-four pounds per hog, when the average weight is 217 pounds varying according to fatness. In 1874-75, the average weight of all the hogs slaughtered in the West and Northwest, was 209.77 pounds; the average weight of lard per hog was 35.02 pounds. This was an exceptional year, the hogs being very fat. In 1876, the United States exported 168,405,839 pounds of lard of the value of $22,429,485 ; an average value of 13.3 cents per pound.

LARGE-FOOTED HAWK.—(See Buzzard.)

LARK. The Meadow lark, or American starling is the best known of our larks. Its song is of exceeding sweetness, the few plaintive notes it utters being welcome to all as one of the earliest harbingers of spring. It is one of the most beneficial of birds to the farmers, living exclusively on insects and seeds in the cultivated fields and meadows. It is one of our most common birds West, is found in the southern New England States, and thence South and West. Nuttall says, in mild winters it remains through the year, but generally leaves for the South late in the fall, and returns about the second or third week in March, . It commences building about the second week in May, sometimes earlier ; the locality is generally in a meadow or low field. The nest is usually built in a tussock of grass; it is pretty compact, made of dry, wiry grass, to which a hidden and almost winding path is made, and generally so well concealed that the nest is only to be found when the bird is flushed. Their food consists of the larvæ of various insects, as well as worms, beetles and grass seeds, to assist the digestion of which they swallow a considerable portion of gravel. It does not appear that this species ever adds berries or fruits of any kind to his fare, like the starling, but usually remains the whole summer in moist meadows, and in winter retires to the open grassy woods, having no inclination to rob the orchard or garden ; and, except in winter, is of a shy, timid, and retiring disposition. But one brood is reared in the season. In the North it is a bird of passage, arriving among the first of the spring visitors.

LARKSPUR. *Delphinium.* Very ornamental, hardy, flowering plants, both annual and perennial, and single and double, combining the richest possible variety of brilliant and effective colors, with great duration and profusion of bloom, The dwarf growing varieties are very effective in long lines and groups ; the candelabra-flowered forms a beautiful pyramid, shaped like a many-branched candlestick. For large beds on lawns, or masses and mixed flower borders, also for cut flowers, the taller growing varieties are the most desirable. The perennial larkspur should be more cultivated in the rural gardens than it is; all are remarkable for great beauty, diversity of shades of color, and decorative qualities. They also differ greatly in their habit of growth ; some produce magnificent spikes of flowers, while others are dwarf, and completely covered with bloom. The principle color is blue, shading from the softest celestial to the darkest purple blue, while all are more or less shaded or marked with some other color. With the exception of *D. cardiopetalum,* all are hardy perennials.

LARVA. The caterpillar or maggot state of insect life; the young of some amphibious animals are also called larvæ.

LARVIPARA. Producing larvæ by the undermining of water, or by an earthquake.

LARYNGOTOMY. The operation of making an opening into the larynx; this is sometimes necessary in cases of choking or severe inflammation, where the opening of the larynx, along which air passes, is closed.

LARYNX. The upper part of the windpipe, formed of cartilage, and lying at the root of the tongue.

LATENT HEAT. Heat supposed to be present in all bodies, and on which their form depends; it can not be felt, but, by a change in the form, is given out, and becomes sensible or free heat. Vapors and gasses contain most, next fluids, and last solids; so that, by the abstraction of heat, vapors are condensed, fluids freeze, and, by the reverse, solids become fluid or gaseous.

LATERITIOUS. A deposit of a reddish color from urine, etc.

LATEX. The milky or elaborated juices of plants: it circulates in a peculiar arrangement of tubes called the *laticiferous* vessels, which anastomose over the plant.

LATHYRUS. A genus of handsome climbing, leguminous plants, much cultivated for ornament.

LATICIFEROUS VESSELS. Milk vessels; they carry the *latex.*

LAUDANUM. Opium dissolved in alcohol, tincture of opium.

LAUREL. Shrubs, or small trees, of the genus *Laurus;* several are evergreen; they yield aromatic resins and oils.

LAURINE. A fatty, acrid substance, found in the berries of the common laurel, *Laurus communis.*

LAVA. The porous molten mineral matter which has flowed from volcanoes.

LAVENDER. A plant of the order *Labiatæ. Lavendula vera,* is the variety from which the lavender oil is made; which is distilled from the flowers. It is a small shrub from the south of Europe, but not hardy in the North and West. *L. spica* yields oil of spike. This is darker in color, not so agreeable in its perfume. It is an ingredient in some liniments, and is used in mixing colors for painting on porcelain, and in the preparation of certain varnishes.

LAVER. *Porphyra laciniata vulgaris.* A seaweed eaten as a delicacy when boiled; green laver (*Ulva latissima*) sometimes is substituted.

LAW. Laws relating to agriculture, such as bird, dog, fence, forests, manures, roads, stock, weights and measures, etc., should be generally understood by farmers. It would save much costly litigation and neighborhood quarrels. We, therefore, give some of the most important laws in relation to the subjects of interest to the farm. The following digest of the bird laws of the United States was prepared by Hon. J. R. Dodge, one of the most correct statisticians in the United States: In Maine the penalty is one dollar for taking larks, robins, partridges, woodpeckers, or sparrows, between March 1st and July 1st; and ten dollars to the owner of lands, with the liquidation of all damage suffered for any trespass committed, between March 1st and September 1st, in hunting or killing the above birds. The law in New Hampshire prescribes a fine of one dollar for killing, taking, or having in possession, at any season of the year, any robin, thrush, lark, bluebird, oriole, sparrow, swallow, martin, woodpecker, bob-o'-link, yellowbird, linnet, fly-catcher, or warbler, or rail, yellowleg, or sandpiper, between March 1st and August 1st. The fine is three dollars for each snipe, woodcock, or plover, between March 1st and August 1st; or for each partridge, or grouse, or quail, between March 1st and September 1st. One dollar additional is assessed for each bird, if taken in defiance of a published notice by the owner of the land—one-half for the use of the complainant, and the other half to the town or city. The action of the law may be suspended for one year, at any time, by vote of a town or city, so far as relates to such town or city. In Vermont the fine is one dollar in each case for taking, wounding, or killing, or for the destruction of the nest or eggs of the robin, bluebird, yellowbird, cherry, or cedar bird, catbird, kingbird, sparrow, lark, bob-o'link, thrush, chickadee, pewee, wren, warbler, woodpecker, martin, swallow, night-hawk, whippoorwill, groundbird, linnet, plover, phœbe, bunting, humming bird, tattler, and creeper. The penalties for the violation of the Massachusetts bird and game laws are as follows: Two dollars each for killing, at any time, robins, thrushes, linnets, sparrows, bluebirds, bob-o-links, yellowbirds, woodpeckers, or warblers; the same for killing birds on salt marshes, the owner excepted; five dollars for killing partridges or quail, between March 1st and September 1st; woodcock, between March 1st and July 4th; five dollars for trapping or snaring any birds at any time, save partridges; twenty dollars for killing grouse or heath hen at any time, and ten dollars to the owner of the grounds and a search warrant authorized for any one suspected of the offense; and twenty dollars for hunting deer with hounds or dogs in Plymouth or Barnstable counties. There is a fine of one dollar for killing between sunset and one hour before sunrising any plover, curlew, dough-bird, or chicken bird. Any city or town may vote to suspend, within its limits, any of the provisions of this law. The Rhode Island law-makers have prescribed a penalty of two dollars in each case for killing, destroying, selling, buying, or having in possession any lark, robin, wood duck, gray duck, or black duck, between February 1st and September 1st, or quail, partridge, or woodcock between January 1st and September 20th;

snipe, between May 1st and September 20th; grass plover, between February 1st and August 1st; grouse, or heath hen, between January 1st and November 1st, and swallow, or box martin, between May 1st and October 1st; twenty dollars in each case for killing woodcock between January 1st and July 1st. In addition, five dollars may be imposed, to be paid to the owner of the land, for the first offense, and ten dollars for the second offense, besides a liability to damage for trespass. Action must be brought within three months. In Connecticut a law was made in 1850, after much opposition, which has since been modified and rendered more effective. Insectivorous and song birds have greatly increased since, especially near towns and villages, and on the shore of Long Island Sound. A fine of three dollars is imposed for killing, selling, or possessing, or destroying a nest of eggs of woodcocks between the first day of February and the first day of July; pheasants, partridges, or ruffed grouse, between the first day of February and the first day of September; quails of any species, between the first of February and the first of October; wood duck, widgeon, black, gray, broad-bill, canvas-back, or teal duck. The fine is one dollar for killing, or trapping, a nightingale, bluebird, Baltimore oriole, finch, thrush, lark, sparrow, catbird, wren, martin, swallow, or woodpecker, at any time, or a robin, or bob-o'-link, between the first of February and the first of September. The taking of brook or lake trout between September 1st and January 1st is fined one dollar. It is also forbidden under a penalty of ten dollars, to take pheasants, partridges, or quails, on the land of any other person. The laws of New York, both local and general, relative to birds and other game, are numerous, and frequently modified or suspended. By the recent law, insectivorous and other birds are protected between February 1st and October. The fine is placed at five dollars for each woodcock, between January 1st and July 4th; ruffed grouse, between January 1st and September 1st; quail, between January 1st and October 20th; wood, black, gray, and teal duck, between February 1st and August 1st, (excepting upon the shores of Long Island). It is forbidden to catch quail or ruffed grouse with a snare at any time; and it is unlawful to take prairie fowl within ten years, under penalty of ten dollars for each one killed or taken. Five dollars each is the penalty for taking trout between September 1st and March 1st. A penalty is incurred of one hundred dollars and damages for putting lime or drugs in any lake, pond, or stream, by which fish may be injured. Owners of dams, if two feet or more in height, on the tributaries of Lake Ontario, Champlain, or the river St. Lawrence, are required to provide a sluice at an inclination of not more than thirty degrees, suitably constructed and protected, as a passageway for fish. Deer are prohibited game from February 15th to August 1st, in all counties, except Clinton, Franklin, St. Lawrence, Jefferson, Lewis, Herkimer, Hamilton, Essex, Warren, Fulton, and Saratoga, (where the prohibition is taken off only in October,) and in Kings, Queens, and Suffolk, where November is the only month for their pursuit. The fine in the last-mentioned counties is twenty-five dollars each. For fishing, except with hook or line, in certain interior lakes, the fine is twenty-five dollars. A similar penalty attaches to trespass in fishing, after public notice has been given. It is forbidden in Pennsylvania, under penalty of two dollars, to trap, kill, or shoot any blue-bird, swallow, martin, or other insectivorous bird, at any season of the year, and the same penalty attaches to the destruction of eggs or nest of any of the birds mentioned in law. A fine of five dollars is laid for killing rail or reed birds betweed June 1st and September 1st; pheasant, between February 1st and August 1st; woodcock, between February 1st and July 4th; partridge, or rabbit, between February 1st and October 1st, and a similar penalty is incurred by buying these birds out of season to sell out of the State. Laws have tended to restrain men and boys to some extent, yet, it is to be regretted that there is room for great improvement, so far as insectivorous birds are concerned. The game laws of New Jersey impose a fine of five dollars each for killing any partridge, water fowl, grouse, quail, or rabbit, between January 1st and November 1st, or woodcock between January 1st and July 5th; to be recovered with cost of suit, and in default of payment imprisonment for sixty days may be adjudged. A penalty of fifteen dollars is laid for placing decoys for geese, ducks or brant, at a distance of more than three rods from ice, marsh, meadow bank, or sand bar, or for hunting them with a light at night; and it is made unlawful to kill geese, ducks, or brant between April 15th and October 15th, in or about the waters of Barnegat bay, or Manasquon river. The fine is five dollars each for killing geese, ducks or brant, between April 1st and December 1st, at Cape May. A trespass, after having been once forbidden to enter lands, renders one liable to a fine of three dollars. The Secretary of State believes these laws effective, though not very vigorously enforced. By the laws of Delaware it is unlawful for non-residents to catch or kill any wild goose, duck, or other wild fowl, under a penalty of not less than fifty and not more than one hundred dollars. Citizens do not rest under this prohibition. A warrant may be issued by a justice of the peace, upon affidavit that any person has violated this law, and the offender arrested, tried, and, upon conviction, fined not less than fifty nor more than one hundred dollars, and imprisoned until fine and costs are paid. By giving bonds in the sum of two hundred dollars, the arrested party can elect to be tried before the court of general sessions. Any boat, gun, or decoy, used in violation of this law, may be seized and confiscated, and the penalty for resisting an officer is fixed at one hundred dollars. The law does not prohibit persons from killing game on their own premises, but it is unlawful for others to kill a partridge, pheasant, robin, or rabbit, between February 1st and October 15th, (in Newcastle county, between January 1st and October 15th;)woodcock, between February 1st and July 1st. The penalty is one dollar for each bird killed. A person not a citizen of the State, gunning upon land not his own, without permission of the owner, is liable to a fine of five dollars for each bird or other game. Some persons permit gunning upon their property; others exclude all hunters. The penalty of hunting or killing deer is two dollars. No general law for the preservation of game or birds has been enacted in Maryland. Laws of a local character have been made with a limited and partial jurisdiction. In Ohio the penalty is from two to ten dollars for killing, or attempting to injure or kill, at any season of the year, any sparrow, robin, bluebird, martin, thrush, mocking-bird, swallow, meadow lark, pewee, wren, cuckoo, indigo bird, nuthatch, creeper, flicker, warbler or finch, oriole, redbird, or catbird. The same penalty in each case is incurred by disturbing the nest of any of these birds; also for killing dove, wild rabbit, or hare, yellow-hammer or flicker, between February 1st and September 15th From five and to fifteen dollars may be imposed for killing or hunting wild turkey, quail, ruffed grouse, prairie chicken, or wild deer between April 15th and September 1st; woodcock between February 1st and July 4th, and wood duck, teal, or other wild duck between May 1st and September 15th. Exposing for sale or having in possession, incurs the same penalties, and the costs of prosecution are in all cases to be paid by the offender. The Secretary of State says the law is effective through most portions of the State; that there are numerous prosecutions, and judges usually affix the extreme penalty. The penalty for killing small birds in Michigan is fixed at five dollars each, and for wild turkey, partridge, or ruffed grouse between February 1st and September 1st; for woodcock between March 1st and July 1st; prairie chicken or wild duck, goose, or swan between February 1st and August 15th; for quail from January 1st to October 1st. It is made unlawful to destroy nests or eggs. The fines go to the school library fund. Indians and inhabitants of the upper peninsula are exempt from the effect of these provisions. Illinois has no general bird law. In a portion of the counties it is made unlawful to hunt or kill deer, turkey, grouse, prairie hen, or quail, between January 15 and August 15th. A fine of five dollars is imposed in the State of Wisconsin for killing grouse or prairie chicken between December 1st and August 12th, or partridge, ruffed grouse, or quail between December 1st and the first Tuesday of September. An exception is made for the benefit of the Indians not civilized. Half the penalty goes to the prosecutor and half to the county. It is unlawful to kill or take woodcock in Iowa between the 1st of January and 1st of July; prairie hen or chicken between 1st of January and 1st of August, or quail, ruffed grouse, pheasant, or wild turkey, or deer, between the first day of January and 1st of September. In Minnesota the penalty is five dollars each for killing at any time a nightingale, whippoorwill, nighthawk, bluebird, finch, thrush, lark, linnet, sparrow, wren, martin, swallow, bob-o'-link, robin, turtle dove, catbird, or other birds; five dollars for each woodcock, from January 1st to July 4th; partridge or ruffed grouse between January 1st and September 1st; ten dollars for trespass in sporting; twenty-five dollars for killing each deer, elk, or fawn, or having the skin of one in possession between January 1st and August 1st. A fine of five dollars is also imposed for each speckled trout taken, except in Lake Superior, Mississippi, Minnesota, St. Croix and Root rivers. In California there is no law for the preservation of the insectivorous or song-birds Game is so abundant that not even the boys are disposed to kill them. The destruction of hawks, coyotes and other wild animals has caused a marked increase of small birds. In some sections quails have increased so as to prove destructive to farm crops. Wild geese, in some places, do great injury by feeding upon the young grain after it is sprouted. A game law exists which makes it unlawful to kill any quail partridge, grouse or ducks, between March 15th and September 15th, except in San Bernardino and Los Angeles counties. It is also unlawful to kill elk, deer, or antelopes from January 1st to July 1st. A fine of twenty-five dollars is imposed for having in possession or exposing for sale such game. Fines may be laid to the amount of five hundred dollars in a single case. A very stringent bird law exists in the District of Columbia. In 1863 the levy court of the county of Washington passed an ordinance for the protection of insectivorous birds, prohibiting the shooting or taking of such birds under a penalty of five dollars for each bird so killed, possession being held as *prima facie* evidence of killing. The law confiscates the gun of any person carrying or using such weapon on Sundays. Pheasants, partridges, woodcock, snipe, rail or reed birds and blackbirds, may be killed at certain seasons. Only hawks, crows and owls are unprotected. All other birds not here mentioned are protected at all seasons, except the last fifteen days of the year. The rigid enforcement of this strict law has peopled the woods and groves anew in the vicinity of Washington. In giving the laws relating to agriculture we have been obliged to generalize. If the farmer wishes to know specifically as to the latest law on any given subject he must consult his lawyer. We aim simply to give the original laws, those having been amended from time to time. The compiler of these laws says in relation to them: The laws of the several States indicate a transition period between pioneer life, with its inevitable dog companionship, and a state of permanent settlement and superior civilization. The silly prejudice that allows dogs to trespass upon a neighbor's grounds and destroy his sheep, while enacting laws to restrain sheep from wandering from their owner's pasture, is rapidly giving way to a common sense that would make restraint equal and just. In most of the States are certain provisions of a just law upon the subject, but a lack of completeness, or want of penalty attached to neglect in enforcement, render them partly inoperative, or wholly inefficient. In Pennsylvania there is, practically, only a threat held over the heads of the dogs, for which they seem to care very little; in Maine, each separate township has the option to ratify or nullify the general law—a non-committalism that is far worse than no law; in Ohio, dogs are instructed that it is unlawful for them to run at large at night, but their owners are held to no proper responsibility for their effective restraint; and in most other States some radical defect exists. Massachusetts has the best law. It taxes dogs from two to five dollars each; owners are made responsible, under heavy penalty, for their registry and taxation; assessors must make accurate lists, and evasions of the listing are heavily fined; refusal or neglect of officers to execute the law incurs a penalty of one hundred dollars; and untaxed dogs are killed without mercy, and district attorneys are required to prosecute officers who neglect to destroy them. Such a law, or one more guarded and efficient still, should be on the statute book of every State. In Maine a law taxing persons owning or harboring dogs one dollar for each dog was enacted in 1862 with a saving clause as follows: Provided, that towns or cities shall so vote. By its provisions dogs inflicting damage subject their owners to fines of double the amount of the damage done, to be recovered by an action of trespass. Any person may lawfully kill a dog that assaults himself or other person while walking or riding peaceably, or is found worrying, wounding, or killing any domestic animal. Any person finding a dog strolling out of the enclosure of his owner may, within forty-eight hours, make oath before a magistrate that he suspects such dog to be dangerous or mischievous, and notify the owner by giving him a copy of the oath; and if the dog shall be found again at large, he may be lawfully killed; and if he shall thereafter wound a person or kill a domestic animal, the owner shall be liable to treble damages and costs. In 1862 the legislature of New Hampshire levied a tax of one dollar on male and two dollars on female dogs. Prior to this the common law was the only protection enjoyed by owners of flocks. In 1863 a law was enacted forfeiting double the amount of damage done by dogs, recoverable from the owner by an action of debt; or a complaint may be made to the selectmen of towns, who are required, upon proof made within thirty days, to draw an order upon the treasury, which is registered and made payable, in whole or in part, from the fund accruing from the dog tax, on the second Tuesday of March annually. The following is the law of 1862 for Vermont:

Sec. 1. The listers in the several towns of this State shall in each year set all dogs in their respective towns in the grand lists to the owner or keeper of the same at the sum of one dollar each; and no person shall be entitled to have the amount so assessed deducted from their lists in consequence of any debts owing.

Sec. 2. Every owner or keeper of a dog shall, when called upon by the listers for their lists, notify them of the dogs by him owned or kept; and every owner or keeper of a dog who shall neglect or refuse to notify the listers as aforesaid, shall forfeit and pay to the town in which he resides the sum of two dollars, to be recovered in an action on the case in the name of the treasurer of such town, before any court competent to try the same, with full costs.

Sec. 3. It is hereby made the duty of the owner or keeper of a dog, whether set in the lists or not, to cause a collar, with the name of the owner or keeper plainly written thereon, to be worn on the neck of each dog by him owned or kept; and it shall be lawful for any person to kill any dog running at large off the premises of the owner or keeper not having on such collar; and the owner or keeper of such dog shall recover no damage for such killing.

By another law, owners of dogs that have worried or wounded sheep are made liable for double damages and double costs; and they can sustain no action for damages against persons who have killed dogs assaulting them off the premises of their owners, or chasing or worrying sheep. In Massachusetts, where sheep husbandry of a high order is on the increase, stringent and effective laws have been passed. The following is a synopsis of the last law:

An Act concerning dogs and for the protection of sheep and other domestic animals:

Sec. 1. Every owner or keeper of a dog shall annually, on or before the thirtieth day of April, cause it to be registered, numbered, described, and licensed for one year from the first day of the ensuing May, in the office of the clerk of the city or town wherein he resides, and shall cause it to wear around its neck a collar distinctly marked with its owner's name, and the registered number, and shall pay for such license two dollars for a male dog and five dollars for a female dog.

Sections second, third, and fourth provide for licensing and the payment of money into the treasuries:

Sec. 5. Whoever keeps a dog contrary to the provisions of this act shall forfeit fifteen dollars, to be recovered by complaint, and the money shall be paid to the treasurer of the county in which the dog is kept, etc.

Sec. 6. The assessors of the cities and towns shall annually take a list of all dogs owned or kept in their respective cities and towns on the first day of May, with the owners' or keepers' names, and return the same to the city or town clerk on or before the tenth day of July. Any owner or keeper of a dog who shall refuse to give just and true answers to the assessors relative to the ownership thereof shall be punished by a fine of not less than ten dollars.

Sec. 7. Mayors of cities and the chairman of the selectmen of the towns shall annually, within ten days from the first day of July, issue a warrant to one or more police officers or constables, directing them to proceed forthwith either to kill or cause to be killed all dogs within their respective cities or towns not licensed and collared according to the provisions of this act; and any person may, and every police officer and constable shall, kill, or cause to be killed, all such dogs, whenever and wherever found. Such officers, other than those employed under regular pay, shall receive one dollar for each dog so destroyed from the treasurers of their respective counties, etc.

Sec. 8. The mayors of cities and the chairman of the selectmen of towns shall, after issuing their warrant to police officers or constables, as specified in the preceding section, forthwith certify the fact under oath to the district attorneys of their respective districts, whose duty it shall be to prosecute all such officers as fail to comply with this requirement.

Sec. 9. Whoever suffers loss by the worrying, maiming, or killing of his sheep, lambs, or other domestic animals by dogs, may inform the mayor of the city, or the chairman of the selectmen of the town wherein the damage was done, who shall appoint two disinterested persons, who, with the mayor or chairman of the selectmen, shall proceed to the premises where the damage was done, and determine whether the damage was inflicted by dogs, and if so, appraise said damage. The amount of said damage shall be certified by the board of appraisers, and, except in the county of Suffolk, be transmitted to the county commissioners, who shall during the month of December examine all such bills, and, when any doubt exists, may summon the appraisers, and make such examination as they may think proper and shall issue an order upon the treasurer of the county in which the damage was done for all or any part thereof, as justice and equity may require. The treasurer shall annually, on the first day of January, pay all such orders in full, if the gross amount received by him under the provisions of this act, and not previously paid out, is sufficient therefor; otherwise, he shall divide such amount *pro rata* among such orders in full discharge thereof. The board of appraisers shall receive from the county, or in the county of Suffolk from the city or town treasurer, out of the moneys received under the provisions of this act, the sum of one dollar each for every examination made by them as prescribed in this section.

Sec. 10. Any town, city, or county officer refusing or neglecting to perform the duties herein imposed upon him, shall be punished by a fine not exceeding one hundred dollars, to be paid, except in the county of Suffolk, into the county treasury.

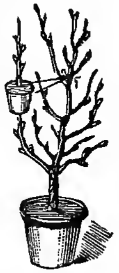
Sec. 11. The treasurer of any county may, in an action of tort against the owner or keeper of any dog concerned in doing damage to sheep, lambs, or other domestic animals in said county, which damage has been ordered to be paid by the county commissioners, recover the full amount thereof to the use of said county. If the amount so recovered exceeds the amount so received by the owner of the sheep or other animals, under the provisions of section nine, the excess shall be paid by the county treasurer to such owner. All fines and penalties provided in this act may be recovered on complaint before any police court or trial justice in the county where the offence is committed. Moneys received by the treasurer of any county, city, or town, under the provisions of this act, and not expended in accordance with its provisions, may be applied to the payment of any county, city, or town expenses.

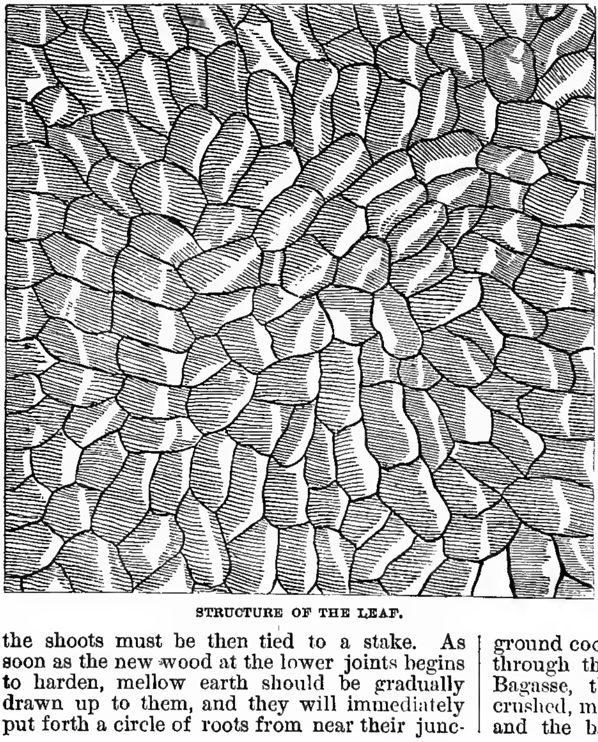
In Rhode Island, by the law of 1860, a dog might be killed with impunity if found without a collar bearing his owner's initials, or worrying or wounding sheep or other stock out of the enclosure of his owner. Any person might make oath to any case of injury, or to the special ill-fame of any particular whelp, and if the allegation was sustained, the dog must be confined, or the life of the animal was forfeited. An additional law has just been passed, which requires dogs to be collared, registered, numbered, described, and licensed, with the payment of $1.15 for each male and $5.15 for each female dog, before the last day of April, and one dollar additional for each dog after that date, and previous to the first of June. It provides for the appointment of suitable persons to make a list of the owners or keepers of dogs, to be returned to the clerk previous to the first of May, who is required to furnish to such persons a list of all dogs licensed for the current year, and to make another list of those not licensed, with the name of the owner or keeper, to be suitably posted or advertised. Any one keeping a dog contrary to these provisions is liable to a fine of ten dollars; and persons appointed to make the lists are required to make complaint and prosecute delinquents prior to the first of July. Such persons and constables and police officers are required to kill and bury all unlicensed dogs, and any person may lawfully do so, and for such service the sum of one dollar shall be paid. Removal of a collar is punishable by fine not exceeding fifty dollars. Damages to sheep are recoverable upon proof made within thirty days from the town or city treasury on the first day of June, or a *pro rata* proportion of them if the tax fund is insufficient for payment in full; and the city or town may then recover from the owner of the dog doing the mischief. By the law of Connecticut for the protection of sheep—that of July, 1863—the tax upon male dogs is one dollar each, females two dollars. The selectmen are authorized to collect of negligent collectors the taxes unpaid, as in the case of other arrearages due from collectors; and they are not empowered to abate such tax unless upon satisfactory proof that the dog is dead. The selectmen are also empowered to institute suit against the owners of dogs for the amount of damage for sheep maimed or killed; and if the owner resides in another town, the suit may be brought against that town. The provisions of the former law, yet partially in force, require the registry of all dogs over three months old, and sanction the killing of all not registered, and persons neglecting or refusing to register are liable to a fine of three dollars each. Dogs of known bad character shall be killed, although registered; and it is lawful to kill any dog taken in the act of worrying sheep. The laws of New York upon this subject, as amended by that of 1862, impose a tax of fifty cents for the first dog, $2 for each additional; $3 for the first female dog, and $5 for each additional. The assessors are required to annex to the assessment roll the names of persons liable, and supervisors must return them, when, if failure in paying the tax occurs, it becomes the duty of the collector, and the privilege of any other man, to kill the dog. The collector has a commission of ten per cent. on fines, and one dollar for each dog killed. The previous enactment provided that the owner of dogs killing sheep should be liable for injuries perpetrated; and in case the owner should not be found, the loss should be paid out of the fund arising from the dog tax. By the laws of New Jersey dogs are taxed from fifty cents to one dollar each. Persons may lawfully kill a dog found worrying or wounding sheep: damages sustained by such depredations are collectible from the township committee, if the fund arising from such tax is sufficient. If the owner of a dog committing depredations shall neglect for twenty-four hours after notification to kill the animal, he shall forfeit ten dollars and costs to any person suing, and triple damages to the owner of the stock injured or killed. A provision is made for the assessment of damages sustained, to be certified by two disinterested freeholders, the amount not to exceed five dollars for each sheep or lamb killed. Some counties have had special enactments allowing full damages to be paid. By the provisions of a more recent act actual damages sustained by any person are estimated by appraisement by two disinterested freeholders, the oath of the owner being also required as to real cost and value, the township where the injury was committed paying the owner, and the amount annually ascertained being laid upon the owners of dogs as a dog tax. No effective law is in existence in Pennsylvania for the protection of sheep. The owner of a dog, knowing that he has worried or killed sheep, and failing to kill him after such knowledge, is liable for all damages done by him thereafter. A dog may destroy a flock of sheep, without danger to himself or loss to his master, until he has offended a second time. If he kills a second flock, and his owner conveniently ignores the fact of the former offense, he may await, with the wool yet in his teeth, for an opportunity to return again and kill. Delaware legislation, relative to protection of sheep, was initiated early in that State. A law of 1811 made the owners of dogs liable to the value of all sheep killed by them; that of 1820 forfeited the lives of dogs at large, without collars on their necks. By the law of 1811 the tax was from twenty-five to fifty cents for the support of the poor; by that of 1817 it was from fifty cents to $3 for a fund to pay for sheep killed by dogs; by that of 1839 from fifty cents to $1 for county purposes; by that of 1843 one dog was exempt, others $1 each for county purposes; by that of 1853 from $1 to $2 for a fund to pay for sheep killed by dogs. These are repealed, their principal provisions being incorporated in the following laws: The owner or possessor of a dog which shall kill, wound, or worry a sheep, or lamb, shall be liable to pay the owner of such sheep, or lamb, the full value thereof, and it shall be lawful for any person to kill such dog. It shall be lawful for any person to kill any dog running at large in Newcastle county, beyond the owner's premises, without a collar upon his neck with the owner's name upon it. The law of 1862 requires an assessment list, of persons owning dogs, to be returned to the levy court. The tax is placed at fifty cents for each male and $1 for each additional dog, and $2 for each female dog, which shall procure the fund from which damages shall be paid, not to exceed $3 for each lamb and $5 for each sheep injured or killed, the remainder, if any, to go into the school fund. A dog not on the assessment list, which may be wandering or caught worrying sheep, may be killed. Persons paying taxes upon dogs are deemed to have property therein, and may recover damages for theft of or injury to such dogs. In Maryland the owner of a dog proved guilty of killing or injuring sheep, is required, upon complaint and exhibition of proof, to kill such dog, in default of which the owner of the sheep may kill him off the premises of his owner, or require a constable to do so, wherever found. If the dog shall be killed immediately by his owner, the owner of the sheep injured can have no cause of action; if not thus killed, his owner is liable for double damages, with costs, recoverable by an action of debt. Several laws have been enacted in Ohio to restrain dogs, none of which have been very stringent or effective, or generally executed. One was passed by the general assembly in 1863, declaring it unlawful for any dog to run at large off the premises of the owner in the night season, between the hours of seven o'clock in the evening and six o'clock in the morning, unless accompanied by the person owning or harboring the animal; and the owner or keeper is required to keep the dog upon his premises between those hours. It is of so negative and incomplete a character as to be practically worthless. The only real protection of an Ohio flock is a well loaded gun in the hands of its owner. In Indiana a license is required, at fifty cents for the first male dog, one dollar for each additional dog, and one dollar in every case for a female dog. All unlicensed dogs are declared nuisances that may lawfully be killed. Accruing funds are set apart for the payment of damages suffered from injuries to sheep in the several townships. The sufferer has his option of the following remedies: Within ten days after having knowledge of such depredations, he may substantiate it to the satisfaction of the township trustee, and draw the amount at the end of the current year, or a *pro rata* proportion if the fund is deficient; or he may recover by suit full damages from the owner of the dog. A fine of from five to fifty dollars and liability to damages, recoverable by the owner, are the penalties for killing licensed dogs that maintain a fair canine character. The Secretary of the Board of Agriculture reports that the law is so defective that it virtually amounts to nothing. In Michigan a law approved March 29, 1850, authorizes the destruction of dogs attacking any kind of domestic animals, except on the premises of the owner of the dog, and such owner is liable for double the amount of damages done by the dog. When notified of such damage, neglect of the owner to kill the dog is punishable by a fine of $3, and $1.50 additional for every forty-eight hours thereafter, until such dog shall be killed. Supervisors, upon complaint of a citizen, verified by his oath, are required to prosecute and recover the fines imposed by this act. An act was passed March 20, 1863, requiring township assessors to ascertain the number of dogs liable to be taxed, and the names of their owners; and if such owners refuse for ten days after demand to pay the taxes assessed, it becomes lawful to kill the dogs so taxed. By the law of 1860, dogs in Wisconsin are required to be numbered, collared, registered and licensed on payment of one dollar for males and three dollars for females; and police officers, constables, and marshals are required to kill and bury all unregistered dogs, and to receive twenty-five cents for such service. A person may be fined fifty dollars for removing a collar. Persons suffering loss from dogs are paid full damages at the first of April, if the tax fund is sufficient; if not, *pro rata;* and the owner of the dog is liable to the town for the full amount. The fine for keeping unregistered dogs is five dollars. Officers neglecting, or refusing to obey the law, are fined $20 for every twenty-four hours of such neglect. Towns may increase the license not more than one dollar, and the penalty not more than ten. The following is an epitome of the law of Minnesota, of March, 1863, which repeals previous enactments on the subject: Every owner or keeper of a dog shall cause such dog to be registered, numbered, described, and licensed, paying one dollar for each male and two dollars for each female. The township or city clerk shall conspicuously post a list of all licensed dogs, and furnish one to constables and chief of police. Failure to license shall make one liable to a penalty of ten dollars. Stealing or poisoning a dog is punishable by fine not exceeding fifty dollars, and killing subjects to liability for damages double the value of the dog. Constables and police officers shall and any person may, kill any unlicensed dog; any one may also kill a dog assaulting him, or worrying sheep out of the enclosure of his owner. Within thirty days after suffering injury or loss of sheep by dogs, proof of damages may be presented to the county auditor, who may draw an order upon the treasurer, payable from the fund accruing from taxes of dogs, when the city or town may sue and recover full damages from the owner of the dog. It is made the duty of the mayor and aldermen of cities, and the supervisors of towns, to require the destruction of unlicensed dogs, and officers refusing or neglecting to perform these duties are liable to a fine of twenty-five dollars for the benefit of schools. All of these penalties may be recovered, on complaint by any householder, before any justice of the peace of the county. Money remaining after the yearly payments from the tax fund is turned over to the school fund. A law was passed in 1862 by the Iowa legislature for the protection of sheep against the ravages of dogs. At the following session, called with reference to legislation in the interest of the soldiers, the law was repealed. We have given considerable space to the summary of the dog laws, for the reason that they interest many—those who keep animals subject to be worried, and those who keep dogs. From these, communities will easily understand the laws necessary to be enacted in the special cases that may occcur in each State. The laws concerning manures (commercial) are constantly varying in those States where the sale is an important industry. No commercial manures should be bought, except accompanied with an analysis, and from parties of known business probity. (See Manures.) The fence and stock laws are contained in the article Fencing, which see. The laws in relation to Forestry by the general Government grants eighty or 160 acres to the settler who plants and cultivates a certain area in forest. Individual States have done something to encourage tree planting through the remission of taxes. Horticultural Societies and State Boards of Agriculture have offered premiums, and have discussed the benefits of tree planting. Thus inducing the prosecution of this necessary and important work. So far as the laws of Congress are concerned the new settlers who have planted groves have been illy able to incur the labor of tree planting, as necessary as this work is, for the land that from one to three hundred dollars would have bought. Speculators, first incited the laws that they might reap the benefits, in having groves adjacent to the lands which they were holding until the new settlers had made them valuable by demonstrating the adaptability of the soil to cultivation. These laws have been several times amended until now the settler acquires title to 160 acres of Government land if he shall plant and keep in cultivation ten acres of the same for five years. In relation to taxation for road purposes in Iowa, it is as follows: The Board of Supervisors has the general supervision of roads in the county, with power to establish or change them as provided by law. The town trustees levy a road tax each year of not less than one mill nor more than three on the dollar of the taxable property in each road district. A road supervisor is elected in each district, who has the supervision of the roads in his district, and it is his duty to keep these roads in as good repair as he can with the funds at his disposal; it is also his duty to require each able-bodied man between twenty-one and fifty years of age to perform two days' labor on the roads, between April and August of each year, himself or by proxy. There is great similarity in the systems of taxation, it being generally a poll tax in labor, varying in the different States from one day to five per annum; and in some portions of the country a money tax, varying from one mill to two cents on the one hundred dollars; and in others a tax for bridge purposes alone, as high as four cents on the one hundred dollars of taxable property. Owing to the abundance and excellence of material in some regions, and the scarcity and inferiority of it in others, there is a difference of at least tenfold in the cost of construction and maintenance of good roads. Good ones are the exceptions in all the States. In a majority of the States there are general stock laws prohibiting cattle and other stock from running at large; in some instances, however, authority is delegated to counties or towns to make by-laws upon the subject, or there is special legislation for particular counties or districts. The law of estrays differs in the various States in no essential particulars. If an animal is found running at large, in violation of law, it may be taken up and impounded, where public pounds have been provided; or it may be held by the person so taking up, on his own premises. If the owner is known, notice must be given him at once; if unknown, the animal must be advertised for a specified time; and no owner making claim, it must be sold to the highest bidder. The person taking up the estray is entitled to a reasonable compensation for maintaining the beast. In some States, after a certain time, the estray becomes the property of the person taking it up, the prescribed legal notice having been given. When an animal is found doing damage on the land of another, the fences being constructed according to law, it may be held as security for damages. In all cases where the owner is known, he must be notified of the facts, and a reasonable time allowed him to reclaim and to inspect damages. In the majority of the States, also, owners of stock are required to adopt certain ear marks, marks, or brands, and to make a record of them. A glance at some of the principal features of the laws relating to stock in the several States will show the importance attached to the subject, and may prove suggestive to communities where legislation is defective. In Maine and New Hampshire, towns may make by-laws concerning the running of animals at large. The laws of Maine provide that persons injured by beasts may sue for damages, and distrain the animal. New Hampshire allows the owner of stock impounded for doing damage, four days to respond to notice of the fact; and if he fails to answer, the animals may be sold and the amount of the damage be deducted from the proceeds. In Vermont, twenty days are allowed for redemption. Ungelded animals are not allowed to run at large. Rams must be restrained from August 1st, to December 1st, and be marked with the initials of the owner's name; and if found at large, a forfeit of five dollars is due for each one taken up, to the person so taking up. The owner of such animals is responsible for all damage done by them. Sheep infected with foot-rot or scab, must be diligently restrained, and for all damages resulting from neglect of this provision the owner is responsible, and is also subject to a fine of ten dollars. Any person finding such diseased animals at large, may take them as forfeit, and no action at law, or in equity will lie for their recovery. Any person who shall drive, or in any manner bring, into the State any neat cattle, knowing them, or any of them, to have the pleuro-pneumonia, or of having been exposed to that disease, is liable to a forfeit of a sum not over five hundred dollars, or to imprisonment in a county jail for not more than twelve months, nor less than one month. Towns may establish regulations, appoint officers or agents, and raise and appropriate money for the purpose of preventing and arresting the spread of pleuro-pneumonia. The laws of Massachusetts provide that when a person is injured in his crops or other property by sheep, swine, horses, mules, or neat cattle, he may recover damages in an action of tort, against the owner of the beasts, or by distraining the beasts doing the damage; but if it be found that the beasts were lawfully on the adjoining lands, and escaped therefrom in consequence of the neglect of the person who suffered the damage to maintain his part of the division fence, the owner of the beasts shall not be liable for such damages. The selectmen of towns and the mayor and aldermen of cities, in case of the existence of pleuro-pneumonia or any other contagious disease among cattle, shall cause the infected animals or those exposed to infection to be secured in some suitable place or places, and kept isolated, the expense of keeping to be paid, one-fifth by city or town, and four-fifths by the State. They may prohibit the departure of cattle from any enclosure, or exclude them therefrom; may make rules in writing to regulate or prohibit the passage of any neat cattle to, or through their respective cities or towns, or from place to place and arrest and detain them at the cost of the owners. They are authorized to brand infected animals or those exposed to infection, with the letter P on the rump. For selling an animal so branded, there is liability to fine not exceeding $500, or imprisonment not exceeding one year. Notice of any suspicion of the existence of contagious disease must be given, with a penalty for neglect or refusal. A board of commissioners is appointed for the State, with authority to use any measure to control the introduction of diseased cattle into the State, or the spread of the disease. The rules and regulations made by this board supersede those of the selectmen of towns, and mayor and aldermen of cities. The moving of cattle into other States without permission is prohibited. The law of 1867 provides that no cattle diseased, or suspected of being diseased, shall be killed, except by order of the governor. The owners of cattle ordered to be killed are indemnified. In Rhode Island, animals trespassing on lands are held a year and a day; and if a horse, must have a withe kept about his neck during that time. Each town is required to erect and maintain at its own charge one or more public pounds, and it is lawful for any freeholder or qualified elector or field driver, and it is made the duty of every surveyor of highways, to take up and impound any horse, neat cattle, sheep, or hogs found at large on any highway or common. Provisions of the act extend also to goats and geese. In 1860, in view of the dangerous disease which had become prevalent in other States, the general assembly enacted that neat cattle might only be brought into the State from places west of the Connecticut river, upon thoroughfares leading into the western and the southern portions of the State, under regulations established by a board of commissioners, until they should prohibit importations from any of said places. For a violation of the provisions of the act, a penalty was provided, not exceeding $300 for each offense, and liability to indictment, and, on conviction, imprisonment not exceeding one year. In case of the introduction of a number of diseased cattle at the same time, the introduction of each animal is to be deemed a separate and distinct offense. Town councils are empowered to take all necessary measures to prevent the breaking out or spreading of any infectious diseases among the neat cattle in their respective towns, and to prescribe penalties in money, not exceeding $500. A board of commissioners is provided for, to be appointed by the governor, consisting of one person from each county, to see that the law is faithfully executed. It is made the especial duty of the board to endeavor to obtain full information in relation to the diseases known as pleuro-pneumonia, and to publish and circulate the same, at their discretion; and in case the disease should break out, or there should be a reasonable suspicion of its existence in any town, they are required to examine the several cases and publish the result of their examination, in order that the public may have correct information. If satisfied of its existence in any town, they must give public notice of the fact in printed handbills, posted up; and, thereafter, any incorporated company or person who may drive, carry, or transport any neat cattle out of the town into any other town in the State, is liable to the penalties above stated. Any person who sells or offers to sell any cattle known to be infected with pleuro-pneumonia, or with any disease dangerous to public health, is liable to indictment, and, on conviction, to punishment by fine not exceeding $1,000, or imprisonment not exceeding two years. The act of March 26, 1864, provides that any person knowingly bringing into the State any neat cattle or other animals suffering from any infectious disease, or who knowingly exposes such cattle or other animal to other cattle and animals not infected with such disease, shall upon conviction, pay a fine of not less than $100, and not exceeding $500. The laws of Connecticut allow owners of sheep to keep flocks in common, and to make their own rules and regulations concerning their care and safety. No horses, asses, mules, neat cattle, sheep, swine, or geese are allowed to go at large in any highway or common, or to roam at large for the purpose of being kept or pastured on the highway or commons, either with or without a keeper. Any person may seize and take into his custody and possession any animal which may be trespassing upon his premises, provided the animal enter from the highway, or through a fence belonging to the owner of the animal, or through a lawful fence belonging to any other person. He must give immediate notice to the owner if known, and may demand for every horse, mule, ass, ox, cow, or calf, twenty-five cents; and for every sheep, goat, goose, or swine, ten cents; together with just damages for injuries occasioned by such animals, if applied for within twenty-four hours after such notice shall have been given. If the owner is not known, the animal shall be sold by the town clerk, after due public notice. The cattle laws of New York allow any person to seize and take into his custody any animal which may be in any public highway, and opposite to land owned or occupied by him, or which may be trespassing upon his premises. Notice must be given to a justice of the peace, or a commissioner of highways of the town in which the seizure has been made, who shall post up notices in six public places that the animal will be sold in not less than fifteen nor more than thirty days. The surplus money, after payment of all charges is subject to the order of the owner for one year. The owner, before sale, may pay all charges and take the animal. If the animal has been trespassing by the willful act of another than the owner to effect that object, the owner is entitled to the animal upon making demand, after paying the compensation fixed by the justice or commissioner, but no other costs; and the person committing such willful act will be held liable to a penalty of twenty dollars. In New Jersey town committees, upon notice of the existence of any disease supposed to be contagious, are required personally to examine the cause, and if the symptoms which characterize contagious diseases are exhibited, shall cause such animals to be removed and kept separate and apart from other cattle and stock, five hundred feet distant from any highway, and the same distance from any and all neighbors. If any die of the disease, or are killed, they must be buried immediately, five hundred feet distant etc., as above. No cattle that have been sick, and have recovered from any supposed contagious or infectious disease, shall mix with other cattle, or be removed, unless permission has been given by the town committee. Any person knowingly storing a hide, or any other portion of a diseased animal, is subject to a fine. The town committee are authorized to prohibit the importation or passage of cattle from other places into or through their respective towns. After notice of prohibition, owners are liable to a fine of $100 for every animal driven into a township. A fine of $100 is imposed for every animal sold and known to be diseased. The act of 1866 authorizes the Agricultural Society of the State to take measures for preventing the introduction or increase of rinderpest, and any other disease among cattle, at their discretion. And also animals affected with glanders are authorized to be killed. Cattle must not be marked by cropping both ears; nor must either ear be cropped more than one inch. The running of cattle at large is controlled in Pennsylvania by towns and counties, through special legislation. The sale of cattle or sheep affected with pleuro-pneumonia, or any other contagious or infectious disease, is punished by a fine not exceeding $500, or imprisonment not exceeding six months. Animals must not be sold alive from, or slaughtered on, premises where disease is known to exist, nor for a period of two months after disease shall have disappeared from the premises. Cattle and sheep are not allowed to run at large where any contagious disease prevails. Constables of townships are required to take up and confine any animals so found, until all costs are paid. In Delaware, by act of general assembly, cattle are forbidden to run at large in certain districts. Stallions over eighteen months old are not permitted to be at large. The laws of Maryland provide that any person aggrieved by trespass upon his premises of any cattle, hogs, or sheep in the possession or care of a non-resident, may impound them, and have the damages sustained by the trespass, valued on oath by two disinterested citizens of his county, and the animals may be sold for the damages and costs. The laws of Virginia provide that if any horses, cattle, hogs, sheep, or goats enter into any grounds inclosed by a lawful fence, the owner or manager shall be liable to the owner of the ground for all damages; and for every succeeding trespass by such animals, the owner shall be liable for double damages; and, after having given at least five days' notice to the owner of the animals of the fact of two previous trespasses, the aggrieved party shall be entitled to the animals if again found trespassing on the same lands. Horses diseased and unaltered, are not allowed to be at large. Every person shall so restrain his distempered cattle, or such as are under his care, that they may not go at large off the land to which they belong; and no person shall drive any distempered cattle into or through the State, or from one part of it to another, unless it be to remove them from one piece of ground to another of the same owner; and when any such cattle die, the owner thereof, or person having them in charge, shall cause them to be buried (with their hides on) four feet deep. Any justice, upon proof before him that any cattle are going at large, or are driven in or through his county or corporation, in violation of law, may direct the owner to impound them; and if he fail to do so, or suffer them to escape before obtaining a certificate that they may be removed with safety, they shall, by order of the justice, be killed and buried four feet deep, with their hides on, but so cut that no one may be tempted to dig them up. For the protection of sheep special laws have been passed taxing dogs in certain counties, and for their restraint in those counties. In North Carolina, if cattle are driven from one part of the State to another, they must be certified to be healthy, sound, and free from any infectious distemper; the granting of such certificate by any justice, without affidavit, is a misdemeanor in office. Stallions and mules over two years old are not allowed to go at large, under a penalty of twenty dollars. Damages for injury done by trespassing animals are recoverable as in other States. In South Carolina horses, cattle, hogs, sheep, or goats breaking into any field having a crop of any kind growing or ungathered, with a lawful fence, may be seized and kept confined until notice is given to the owner, within twenty-four hours of the seizure, who shall be bound to pay the owner of such field fifty cents a head for each horse or mule, and twenty-five cents for every head of cattle, hogs, etc., before he is entitled to have the animal delivered up to him. For the second breaking, within one month after the first, the owner is liable to the person injured for all damages sustained, in addition to the fine. Full satisfaction lies for injuring any animal found in any field where the fence is not a lawful one. In the State of Georgia, if any trespass or damage is committed by stock on any lands not protected by lawful fences, the owner of the animal is not liable to answer for trespass; and if the owner of the premises should kill or injure the animal in any manner, he is liable in three times the damages. When fences are made pursuant to law, and any animal breaks in, the owner of the inclosure shall not kill or injure him for the first breaking, and not until after notice is given to the agent or owner, if possible, but the owner shall be liable for double the damage done by his stock. In Florida there can be no trespass or damage if the fence is not a lawful one; nor in such case can stakes, canes, or other devices to maim or kill cattle, sheep, swine, etc., be used, under a penalty of ten dollars for each offense, and full damages. Marks upon stock are required. Any person is allowed in Alabama to take up any horse, mare, jack, neat cattle, hog, or sheep found running at large, if the owner is unknown. If any stallion or jackass over two years of age, is found at large it must be taken before a justice, who shall cause it to be advertised. The taker up is entitled to five dollars from the owner, and reasonable compensation for keeping. If such stallion or jackass is not claimed within three months it may be gelded. The laws of Mississippi provide that every owner of cattle, horses, mules, hogs, sheep, or goats shall be liable for all injuries and trespasses committed by breaking into grounds inclosed by legal fence. If any person whose fence is not a lawful one, shall hurt, wound, lame, or kill, by shooting, or hunting with dogs, or otherwise, any cattle, etc., that may have broken into his inclosure, he shall pay the owner double damages. A ranger is elected in each county to attend specially to estrays, of which he is required to keep a record. When any person finds horses, mules, jacks, cattle, sheep, or hogs straying upon his land, he may take them up and forthwith send them to the owner, if known; if unknown, he must give notice to the ranger, or some justice of the peace. The owner of all estrays appraised at ten dollars and not exceeding twenty dollars, is allowed six months, and if less than ten dollars, three months, from the date of certificate of appraisement, to claim and prove his property. It is not lawful for any drover or other person to drive any horses, mules, cattle, hogs, or sheep of another from the range to which they belong; but it is made his duty if any such stock join his, to halt immediately at the nearest pen, or some other convenient place, and separate such stock as does not belong to him, or to the person by whom he may be employed. For neglect a forfeit of twenty dollars for every offense is provided, and liability to all damages. Any person may confine and geld any stallions that are above the age of two years, found running at large, at the risk of the owner, but this will not apply to stallions usually kept up, or to those which accidentally escape. Any animal addicted to fence breaking may be taken up by owner of land, who may recover seventy-five cents a day for keeping, provided owner has been notified, if known; but condition of fence may be shown in mitigation of damages. Double damages may be recovered for injury to animals where fence is not a lawful one. Defacing or altering marks of animals subjects to a penalty of imprisonment in the penitentiary for not more than three years, or fine of not more than $500, and imprisonment in county jail for not more than one year, or both. No neat cattle belonging to non-residents are allowed to be taken into Texas for grazing or herding purposes, under pain of forfeiture to the county into which they shall have been so taken. Severe penalties for altering the brands of animals are provided in that State. In Arkansas, if any horse, cattle, or other stock break into any inclosure, the fence being of the required height and sufficiency, the owner of the animal shall, for the first offense make reparation for true damages; for the second offense, double damages; and for the third the party injured may kill the trespassing beasts, without being answerable. If any stallion or jack over two years old is found running at large, the owner may be fined two dollars for the first offense, and ten dollars for each subsequent offense, and is liable for all damages that may be sustained. Any person may take up such animal, and, if not claimed within two days, may castrate, and recover three dollars for doing so; but the life of the animal must not be endangered. If any such animal can not be taken up, he may be killed, if notice be first put up at the court-house, and at three other of the most public places in the county for ten days, accurately describing the animals. In Tennessee stallions and jackasses over fifteen months old are not allowed to run at large under penalty to the owner of not less than five dollars or more than twenty-five dollars. The animal may be taken before the nearest justice of the peace who shall give public notice. If not claimed within three months the animal may be gelded at the risk and expense of the owner. The party taking him up is entitled to five dollars and reasonable expenses for keeping. There is no law in force in West Virginia to prevent cattle from running at large; but if they break into an inclosure and destroy any grain or crops, the owner is liable; provided the fence is a lawful one. A law exists to prevent diseased sheep from traveling on the highway. In Kentucky, breachy and mischievous bulls may be taken up and altered; a jack or stallion may be gelded if found at large, allowing the owner, if known, at the rate of twenty-five miles a day to reach the place where the animal is held, and recover the animal; when the owner is not known, the animal is dealt with as an estray, and may be ordered by a justice to be gelded. If the owner of any distempered cattle permits them to run at large, or drives them through any part of the State, he is liable to a fine of ten dollars for each head; and if any die the owner must cause them to be buried, subject to a penalty of five dollars for neglect in each case. The State of Missouri has created a board of cattle inspectors to prevent the spread of the Texas or Spanish fever. The county court of each county is authorized to appoint three competent and discreet persons to act as a board for the inspection of cattle supposed to be distempered or affected with the disease known as the Texas or Spanish fever. They may stop any drove of cattle. If they adjudge cattle to be diseased or distempered, and in a condition to communicate any contagious or infectious disease, they are required to order the cattle to be removed from the county without delay, upon the same route upon which they came in, if practicable. If the owners comply with the order they will not be further liable; but if they, or the persons having the cattle in charge, willfully delay or neglect to do so, the president of the board will direct the sheriff to drive the cattle out by the route they came in, or to kill them, if the board think it necessary in order to prevent the spread of the disease. The parties owning, or in charge of the cattle ordered to be removed or killed are liable for all the costs that may accrue in case of examination, removal or killing. The act to prevent the introduction of diseased cattle into the State provides that no Texas, Mexican, or Indian cattle shall be driven or otherwise conveyed into any county in the State between the first day of March and the first day of December in each year, but this does not apply to any cattle which have been kept the entire previous winter in the State. Cattle may be carried through the State by railroad or steamboat, provided they are not unloaded, but the railroad company or owners of the steamboat are responsible for all damages which may result from the Spanish or Texas fever, should the same occur along the line of transportation; and the existence of such disease along the route shall be *prima facie* evidence that the disease has been communicated by such transportation. For every head of cattle brought into the State contrary to law a fine of twenty dollars may be recovered, or the party may be imprisoned in the county jail not less than three nor more than twelve months, or may be subjected to both fine and imprisonment. It is lawful for any three or more householders to stop any cattle which they may have good reason to believe are passing through any county in violation of the act. In Illinois the owner of animals breaking through a legal fence is liable to full damages for the first trespass, and to double damages for any subsequent trespass. Where the fence is insufficient, and the land-owner injures or destroys animals, he is answerable in damages. Stallions over one year old are not permitted to run at large; but if so found may be gelded, if the owner does not reclaim them, one day for every fifteen miles' distance of the animal from home being allowed, after notice. Diseased horses, mules, and asses must be kept within the owner's inclosure, under penalty of twenty dollars damages. Estray hogs must be sold from November 1st to March 1st. To convey any Texas or Cherokee cattle into the State between the first day of October and the first day of March renders the party so doing liable to a fine not exceeding $2,000 nor less than $500, and imprisonment at the discretion of the court. Any and all fines are paid into the county treasury, subject to the order of the board of supervisors, or county court, for the purpose of being divided *pro rata* among persons who may have suffered damage or loss on account of any such Texas or Cherokee cattle. All persons or corporations are liable to injured parties for any damage arising from the introduction, by any of them, of any diseased cattle. It is made the duty of any circuit or county judge, or justice of the peace, upon oath of any householder, setting forth that Texas or Cherokee cattle are spreading disease among the native cattle, to forthwith issue a warrant to any sheriff or constable of the county, commanding him to arrest and impound such cattle, and keep them by themselves until the first day of October following. Texas and Cherokee cattle are defined to mean a class or kind of cattle, without reference to the place from which they may have come. In Indiana laws regulating the running at large of stock are local in their application, county boards designating what animals may or may not run at large. However, when any animal is found at large contrary to local law, and has been taken up, the owner may reclaim it within ten days, after which time the animal may be sold. It is unlawful in the State of Ohio for any one to sell, barter, or dispose of, or permit to run at large, any horse, cattle, sheep, or other domestic animal, knowing them to be infected with contagious or infectious disease, or to have them indirectly exposed thereto, unless he first duly informs the party to whom he may sell as to the facts. The fine for so doing is not less than $20 nor more than $200, with costs, or confinement in the county jail not more than thirty days. For allowing infected animals to come in contact with animals belonging to another, a fine is provided of not less than $50 nor more than $500, with cost of prosecution, or confinement in county jail not less than ten nor more than fifty days. If any horse, mule, ass, or any neat cattle, hogs, sheep, or goats, running at large, break into or enter an inclosure other than inclosures of railroads, the owner is liable for all damages, and the animal so breaking into or entering an inclosure is not exempted from execution issued on any judgment or decree rendered by any court. For allowing any such animals to run at large in any public highway or upon any uninclosed land, or for herding any of them for the purpose of grazing on premises other than those owned or occupied by the owner or keeper of the animals, the party offending is liable, for every violation, to a fine of not less than $1 nor more than $5. But a general permission may be granted by the commissioners of any county for certain animals to run at large, and in counties where there is no such general permission, township trustees may grant special permits, such general and special permits terminating on the first Monday of March of each year; and special permits are revokable at the discretion of the trustees, upon three days' notice in writing to the owner of animals. Special permits must be directed to individuals, and for particular animals described therein. The owner of trespassing animals is liable for all damages upon premises of another without reference to the fence which may inclose the premises. Any person may take up and confine an animal found at large contrary to law, and the owner may reclaim the same within ten days. The fees are as follows: For taking up and advertising each horse or mule, $1; neat cattle, seventy-five cents each; swine, fifty cents each; sheep or geese, twenty-five cents each; and reasonable pay for keeping the same. It is unlawful for the owner or keepers of any animals knowingly to permit them to enter the inclosure of any railroad, or, having entered, to remain therein; or to lead or drive any such animals within the inclosure, or along or upon the track of any railroad, at any other place than the regular street or road crossing, or farm crossing or way. In Michigan it is not lawful for any cattle, horses, sheep, or swine to run at large on the highway, except in those counties or parts of counties where it shall be otherwise determined by the board of supervisors in such county. Where the law is in force, any person may seize and hold in his possession any animal found running at large, and give notice to a justice of the peace or a commissioner of highways, who is required to post up notices describing the animal. The animal must be sold at public outcry in not less than thirty nor more than sixty days after date of notice; but the owner may redeem the animal by paying costs and compensation for keeping—redemption to be made within one year. An animal found trespassing by the willful act of another, may be taken by the owner on demand, after paying reasonable compensation, but the person committing the act is liable to a fine of $20. Any person taking up a beast going at large contrary to law, or contrary to any by-law of a township, is entitled to fifty cents per head for all horses, mules, asses, and neat cattle, and ten cents per head for all sheep, goats, and swine. When any person is injured in his land by animals, he may recover damages in an action for trespass against the owner of the beasts, or by distraining the beasts doing damage, unless the animal shall have been lawfully on adjoining lands, and shall have escaped therefrom in consequence of the neglect of the person who has suffered the damage, to maintain his part of the division fence. The laws of Wisconsin permit towns to make regulations concerning the running of animals at large. The owner or occupant of lands may distrain all beasts doing damage within his inclosure, and when any distress shall be made, the person distraining is required to keep such beasts in some place other than the public pound until his damages are appraised; and within twenty-four hours he shall apply to a justice of the peace, who shall appoint three disinterested free-holders to appraise the damage sustained. If within twenty-four hours after appraisement the damages are not paid, the animals may be placed in the public pound, to be there maintained until the amount of damages and costs is recovered by due process of law. If the owner of any sheep infected with contagious disease, permits any of them to go at large out of his own inclosure at any season of the year, he shall forfeit the sum of $5 for each and every such sheep, to the person who may enter complaint, for each time they are so found running at large. If the owner neglects to restrain such sheep, any person is authorized to take them up and put them in some safe place other than the public pound. Rams are not permitted to go at large between July 15th and December 1st, and the owner forfeits $10 to the person taking up the animal for each time so found abroad. The electors of each town in the State of Minnesota have power at their annual meetings to determine the number of pound masters, and the location of pounds, and regulations for impounding animals, and to fix the time and manner in which cattle, mules, asses, and sheep may be permitted to go at large, provided that no cattle, horses, mules, nor asses be allowed to go at large between the 15th of October and the 1st of April. The owner or occupant of lands may distrain all beasts doing damage upon his lands during the night-time, from eight o'clock in the evening until sunrise; and when any such distress is made the distrainer shall keep such beasts in some secure place other than the public pound, until his damages are appraised, unless the same is made on Sunday, in which case, before the next Tuesday morning thereafter he shall apply to a justice of the peace of the town, who shall appoint three disinterested persons to appraise damages. No damage can be recovered by the owner of any lands for damage committed by any beasts during the day-time, until it is first proved that the lands were inclosed by a lawful fence. Distress may be made at any time before the beasts doing damage escape from the lands, and without regard to the sufficiency of fences. The owner of any horse or other animal, having the disease known as the glanders, who knowingly permits such animal to run at large, or be driven upon any of the highways of the State, or any hotel keeper, or keeper of any public barn, who permits any animal having such disease to be stabled, such person shall be deemed guilty of a misdemeanor, and upon conviction before any justice of the peace, shall be punished by a fine of not more than $100 nor less than $25. In Iowa no stallion, jack, bull, boar, or buck is permitted to run at large. Persons aggrieved are allowed to distrain any such animals, and compel the owner to pay damages. If the animal is not redeemed within seven days, seven days' notice of its sale at public auction must be given, the proceeds to apply on damages after deducting costs. If any domestic animal, lawfully on adjoining land, escapes therefrom in consequence of the neglect of the person suffering the damage to maintain his part of the division fence, the owner of the animal is not liable for any damages. If beasts are not lawfully upon the adjoining land, and came upon it, or if they escaped therefrom into the injured inclosure, in consequence of the neglect of the adjoining owner to maintain a partition fence or any part of one, which it was his duty to maintain, then the owner of the adjoining land shall be liable as well as the owner of beasts. Fence viewers appraise all damages. An act of April 8, 1868, forbids any one to bring into the State, or to have in possession, any Texas, Cherokee, or Indian cattle. Transportation on railroads through the State is not forbidden, nor the driving through any part of the State of such Texas or southern cattle as have been wintered at least one winter north of the southern boundary of the State of Missouri or Kansas. The penalty of violation is a fine not exceeding $1,000, or imprisonment in county jail at the discretion of the court, not to exceed six months, together with all damages that may accrue by reason of such violation of the law. Any one driving or importing diseased sheep into the State, knowing the disease to be contagious, is deemed guilty of misdemeanor, and is punishable by fine of not less than $50 nor more than $100. The same fine is imposed upon any person who may turn out of his inclosure, or sell sheep, knowing them to be diseased. In Kansas, when a majority of the electors in any township petition county commissioners for orders to confine animals during the night-time, such orders shall be made and notice thereof given. The owner is liable for depredations of animals during the continuance of such orders, without regard to condition of fences. Persons damaged in their property have a lien upon the stock. If any stallion or jack over the age of two years is found at large, the owner, if known, must be notified of the fact; and if he fails or refuses to confine the animal he is liable to a fine of $5 for the first offense, and $10 for each subsequent offense, and all damages. Stallions and jacks, not used for breeding purposes, may be castrated by the person taking them up, if the owner fails, after three days' notice, to reclaim the same, and pay damages, or such animals may be killed after six days' notice. Any bull, boar, or stag found running at large may be taken up at any time or place. Electors of townships may decide whether swine may run at large or not, at least ten voters having petitioned for the submission of the question. No horse, mule, or ass diseased with glanders is allowed to be at large, under a penalty of not less than five dollars nor more than $100. Knowingly to import or drive into the State sheep affected with contagious disease is a misdemeanor, with a fine not to exceed $200. The same penalty is provided for any owner allowing such sheep to run at large, together with responsibility for damages to other owners. Rams must be restrained between June 15th and December 15th, under penalty of five dollars for each day allowed at large. Electors of townships determine whether or not sheep shall run at large. In February, 1867, a sanitary measure was passed for the protection of cattle from the ravages of the Spanish fever. Stock from Texas and the Indian Territory brought into the State between the first day of March and the first day of December in any year, are not to be driven through the State except in the remoter parts on the plains, and then not within five miles of any highway or ranch, except by consent of the owner of the latter. Violation of the law is treated as a misdemeanor, and the first offense is punishable by fine of $100 to $1,000, and imprisonment from thirty days to six months; for subsequent offenses the penalties are doubled. In Nebraska cattle and other stock are restrained in particular counties. The legislation concerning cattle etc., is also of a local character in the State of California. The laws of Oregon interdict the running at large of any stallion, jack, or mule, over eighteen months old, within the months of April, May, June, July, September, and October. If not kept for breeding purposes, the animal may be gelded. If kept for breeding purposes, the distrainer may return him to the owner, and recover two dollars. The owner of such an animal is liable for damages. Animals affected with contagious diseases must not be brought into the State under a penalty of not less than $50 nor more than $500 for the introduction of each animal so diseased.

LAWN. The lawns of England have been celebrated the world over for their verdancy, closeness of texture and general beauty. This is owing to four reasons: A most thorough preparation of the soil, the moist climate, thick sowing of grass seed, and frequent cutting with the lawn mower. In preparing for a lawn, the ground should be plowed deep and heavily manured, because deep tilth and decomposed manure are favorable to the retention of moisture. Thick seeding brings a close firm sward which keeps the ground shaded, frequent mowings, say once in two weeks keeps the sward dense, and prevents the roots from becoming long and straggling. They form a dense mat under the surface and prevent evaporation of moisture from the surface. Thus a closely mown lawn, acts as a constant mulch and the earth will be moister and cooler than on a surface wholly or partially exposed. The thermometer will quickly show this. The moist climate we have not got. Hence, during July and August, it is impossible to keep a lawn perfect in its greenness without a good soaking once a week. Hence, during this time it is not a bad plan to let the grass grow even to a height of ten or twelve inches. After the first heavy rain of the late summer cut the grass as closely as possible, and then go over it with the lawn mower and in three days it will again be perfect. In making a lawn, never use lawn grass mixtures. They are as high priced as they are generally worthless. The basis of a good lawn is in the preparation of the soil. Kentucky Blue grass, *poa pratensis*, Spear grass, *poa compressa*, Red top, *Agrostis vulgaris*, and White clover, *Trifolium repens*, should form the bulk of the grasses used. Rye grass, *Lolium perenne*, is sometimes used, but it does not stand close cutting. Timothy two pounds per acre is good in the formation of a lawn, since it acts as a kind of a nurse to the other grasses. The sowing of oats is often advised for the same purpose. Do not use it. It robs the young grass of nourishment, and is dead just at the time the grass wants the protection most. Timothy is not a good lawn grass, it is too coarse, but it may be easily killed by close cutting late in the summer, since it has a bulb just at the top of the ground, which if cut destroys the grass. Sow lawn grass in August. The following is a good mixture: Red-top, one bushel; Kentucky Blue grass, one bushel; Spear grass, one bushel; and two pounds White clover. Then sow two pounds flat turnip. Divide the grass seed into two parts, sow one-half one way and the other half the other way. This is sufficient for one acre. Finish with the turnip seed and you will not only have your seed sown evenly, but the turnip leaves will partially shade the land, and act as a mulch. Just before it freezes up cover with slough hay or other mulch to protect the grass from heaving the first winter; early the next spring rake off the mulch cleanly, sow two bushels salt per acre, roll as soon as the land is firm enough, and if you have prepared the whole as directed you will have a first class lawn. At any cost, the surface of the land must be perfectly smooth and level before sowing. This may generally be accomplished by means of a revolving or other harrow and a leveler, two or three hard wood scantling eight feet long, one side brought down to a sharp edge, the whole fastened together two feet apart, and drawn by means of a chain from each side ending in a toggle link. If the soil is clayey, plant it to some hoed crop, as potatoes, before making the lawn, and in this case leave it rough for the winter. Then when quite dry in the spring, level and sow. Thus you have that most beautiful of rural objects, a perfect lawn. The following are the general rules, by which a good lawn may be had and kept intact. To have a perfect lawn, says Mr. William Saunders, it is absolutely necessary to have it properly laid down at the outset. This, however, does not consist so much in enriching the soil as in rendering it friable and porous by draining, subsoiling and pulverizing. The main feature in keeping lawns is frequent mowing, and if this is neglected fine lawns can not be maintained. It will matter but little how much expense and skill may have been incurred in the preparation and seeding of the ground if it is allowed to grow at random afterwards, as the strongest foliaged grasses and clover will eventually supersede the finer kinds if the cutting is not regularly attended to. On the other hand, lawns that have been but indifferently prepared may be rendered close and regular by frequent mowing and judicious top-dressing. Early cutting prevents the growth of the coarser grasses and induces lateral growth on the finer, thus covering the surface with a dense foliage, which resists the effects of sun and long-continued dry weather. Every lawn of any pretensions should be kept smooth by a machine. Not only is it economical as regards labor, but it is scarcely practicable to keep it with a scythe so smooth, thick, and velvety as can be done with a good lawn-mower. Another advantage is that the grass is not removed, but falls down in a shower over the roots, forming a very efficient mulching and enabling us to impart to our pleasure grounds all the character of the finest lawns, an attainment that has hitherto been deemed beyond our ability to realize. When the grass becomes thin and of weakly growth a top-dressing of good stable manure should be laid over the surface in December. It is important that the manure should be well rotted before being used, and as occasion offers during winter it should be broken up and manipulated with an iron rake. The object in view is to distribute it evenly over the whole surface. Break it finely, so that it will settle down and nourish the grass roots. When spring opens, the rough, strawy portions, if any are left, should be removed; otherwise it would interfere with the proper keeping of the surface.

LAXATIVE. A gentle-purging medicine.

LAYERING. The laying down of a branch, and covering with earth, in order to induce the formation of roots is termed layering. It used to be extensively practiced with all that class of plants, as carnations, that were supposed not to strike readily from cuttings, and indeed they do not, except under special conditions. But modern scientific horticulture has demonstrated that any plant that will strike from layers will do so from cuttings. Layered plants are stronger however, than those from cuttings. Layering is still quite common with some varieties of grapes, as the Delaware, for instance, that is shy in striking. In the farm garden it is a simple and easy way of propagating, and is done as follows: The branch or shoot to be operated on is cut with a rather long gash, say one or two inches in length, according to size. A sliver of wood is thrust in to hold it apart. It is then bent down and laid in a trench so it may be covered two or three inches deep in moist earth, and firmly pegged in place. In the case of grape vines, the whole branch is covered, when it will generally form roots, and a separate plant at every joint. With carnations and that class of short stemmed plants, the cut portion is pegged down and covered, and the tip of the shoot left out. The following cut will explain the manner of rooting a branch without severing it from the plant. It has been in use for many years with pot plants, and is also useful with hard wooded plants. Select the shoot to be operated upon, pass a small pot carefully over the branch, cut diagonally half way through the branch, about midway of the pot, with a long cut, hold this slit open with a chip, and pack the earth firmly about the branch, fastening the pot so it will not move. The details for layering the grape will answer for all plants that can be layered out of doors. They are as follows: For the propagation of plants for removal, the vine dresser selects such parts of the branches as may suit his purpose when he is going over his vineyard at the season of winter pruning. These are left, instead of being cut off as in the regular trimming; and they must be so situated as to be easily bent down to the ground. After dressing the vineyard in the spring, these branches are either at once pegged down and buried in the soil, with the smaller twigs protruding, or shallow trenches are opened, into which the branch to be layered is simply pegged down, if it be a vigorous cane of the last year's growth. As the spring opens, the shoots must be then tied to a stake. As soon as the new wood at the lower joints begins to harden, mellow earth should be gradually drawn up to them, and they will immediately put forth a circle of roots from near their junction with the old shoot, which roots greatly aid their growth and relieve the mother vine. In the autumn, the layered branches may be taken up and divided, when every bud which has forced up a shoot will be found to have become a strong well-rooted plant; so that, in this way, a large increase may be made, and the roots, being in a circle, are well disposed for planting, and may be removed from the soil without injury. Layers should never be allowed to remain attached to the parent vine after the first season, as they are believed to be injurious. It will also be perceived that this sort of robbery of a plant will materially affect its bearing; so that, where cuttings grow readily, as is remarkably the case with the Catawba, Concord, etc., the plan is not generally pursued. With the Herbemont and the Schuylkill or Cape, which are difficult to grow from cuttings, and with new varieties which it is proposed to multiply, this plan is generally adopted. Some persons prefer layered plants to those grown from cuttings, on account of the arrangement of the roots. For home use, they are greatly to be preferred, because they may be brought into bearing much sooner than cuttings planted in the vineyard at the same time, and because a large number may be grown from the old vines.


POT LAYERING.


STRUCTURE OF THE LEAF.

LEATHER WOOD. *Dirca palustris.* A small indigenous shrub with very flexible branches, and a tough, leathery bark.

LEAVEN. A piece of sour dough used to make other dough light; it is well kneaded into it, and produces fermentation, but inferior to yeast.

LEAVES. The leaves of plants act, in a sense, both as do the stomach and lungs of animals. They are the vital organs and may not be unduly taken away without serious injury to the plant, for just in proportion to the leaf surface so will be the roots. Hence the more leaf surface that is acquired by a newly transplanted tree, the more vigorous will be the root action, for root action can never become vigorous until leaf action is established. Many persons are in the habit of stripping the lower leaves of plants in the garden to feed to pigs and cows. Nothing could be more senseless, since it directly reacts upon the vigor of the plants. The leaves remaining when plants are mature, if suitable for the food of animals, as corn, beets, cabbage, etc., are of value, and the dried or dead leaves are valuable as manure. The leaves of forest trees are especially valuable for mulch, and as a separator for strong heating manure in making hot-beds, since they not only counteract violent fermentation, but cause the heat to be held for a long time through their slow decomposition. As mulch, leaves are cleanly, easily gathered and applied and keep the ground cool, and when decomposed are valuable through the humus, and potash they contain. Bagasse, the stalks of sugar cane after it is crushed, makes an excellent mulch in the South, and the bagasse of sorghum in the North.

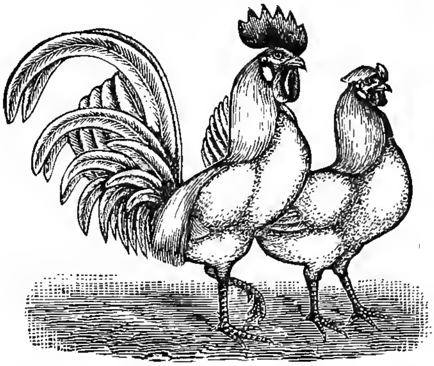
Potato and tomato stalks dry, make an admirable mulch for strawberries in the garden. Where forest leaves are plenty and bedding scarce, these should by all means be gathered in the autumn, and stored away dry for use. The structure of the leaf presents a curious and instructive study. A section of leaf properly prepared, and placed under a strong microscope, will show the breathing pores, numbering often over 60,000 to the square inch, the cellular structure, and the branching vascular bundles. Accompanying we present a section of leaf highly magnified, showing the cellular structure of the orange leaf. When viewed under a high power it becomes an object of much interest. The branching vascular bundles will be distinctly seen, resembling in some respects the arteries and veins of the human body. A careful examination will show that these are also covered with a very fine lace-work of cells under and over them, and interspersed among the latter will be seen a vast assemblage of translucent dottings, each having an opening across it corresponding to those of the stomates, under which they were situated before dissection. The structure of the leaf, taken as a whole, indicates the great necessity of cleanliness and high culture; for the more complicated the organic structure of the plant is, the greater will be the number of its economic products, and the more apt are abortions in the form of fruit to be produced in the case of neglected culture or unfavorable climatic conditions. In plants there are milk-vessels, turpentine, oil-receptacles, and the like, which form canals or cavities between or among the cells, and are filled with the particular product of the plant. Not so with the lower forms of fungi. Their roots may grow in profusion, although frequently torn to pieces, because of their simple form of structure and habits. A single cell of mycelium will germinate, bud, or reproduce its kind as perfectly as will a spore of its fruit.

LEDGERS. In building, the pieces of timber used in scaffolding, which lie parallel to the wall, and horizontal.

LEECH. *Sanguisuga officinalis* and *medicinalis.* They inhabit shallow brooks and ponds, and are valuable in relieving local inflammations, by drawing off an excess of blood.

LEEK. *Allium porrum.* In the United States the leek is less cultivated than in most other countries. It belongs to the onion family. It has always been regarded with particular favor by the Egyptians, who eat it raw with their bread, or as a sauce for meats. It is frequently associated with the name of St. David, the patron saint of Wales, for the reason that Welshmen are accustomed to sport leeks in their hats upon his festival, the first of March. This is a very ancient custom, and we find frequent mention of it among the old writers. Some persons have thought that it commemorates the introduction of the plant into that country by St. David; but more probably, as Shakspeare says, in his Henry the Fifth, it is worn as a memorable trophy of predeceased valor. According to an ancient tradition, in a celebrated victory of the Welsh over the Saxons, in the sixth century, the former under the prelate's directions, were distinguished by leeks which they gathered near the battle ground. As he was supposed to have power to work miracles, it is not strange that their glorious success should have been attributed to this cause. Whatever may be the origin of the custom, it would be quite as remarkable to find a Welshman without his leek on the first of March, as it would to discover a genuine Hibernian without a shamrock in his buttonhole on St. Patrick's Day. For certain purposes the leek is preferred to the onion. The seed of the leek should be sown as early as possible, in a well prepared bed, and transplanted when large enough, in shallow trenches one foot apart. In the row they should be left six inches apart; the soil should be light, rich, and mellow. If the weather turns dry, the plants must be watered, since they are impatient of drought; keep the soil mellow, and draw it about the stems from time to time. The London-flag-leek is hardy, and the variety usually cultivated in the United States. The whole plant is used in various ways, either boiled, or in soups, stews, etc.

LEGHORN FOWLS. The Leghorns are called by Tegetmeier, a well known English authority, an American breed. They certainly are a thoroughly Americanized breed, but are undoubtedly an Italian breed originally, being said to have been first imported from Leghorn, whence their name. They are among the best of our breeds, a modified Spanish fowl, with all their good qualities, and lacking the weak points of the Spanish. They are bred of various colors, except black, but the White and the Brown Leghorns are the most fashionable. The white variety much resemble the Spanish in size and plumage, but are their direct opposite in color. The combs of the cocks are upright, single, large and much serrated; wattles full and large, cream colored or white ear-lobes. The combs of the hens frequently fall or double over. The cut will furnish a good illustration of this strain of Leghorns, as the description will also of the Brown. The Brown Leghorn is precisely like the White, except in color, which is a rich brown. The comb is the same as in the White, legs bright yellow in both White and Brown. The Brown Leghorns have the breast black, splashed with brown, the wings reddish brown, the tail large, full and with the sickle well curved. In the White the sickle is carried more upright. The ear-lobes pure opaque white, rather pendent, thin and close fitting to the head, smooth and free from wrinkles. The neck, hackle and saddle of the White Leghorns may be tinged with gold or straw color, but all



WHITE LEGHORNS.

the rest of the plumage must be pure white. As showing the appreciation of the Leghorns in England, whence they were sent from breeders in the United States, Tegetmeier says, the birds are of a sprightly, active carriage, good foragers, they are abundant layers of full sized eggs, the hens rarely showing an inclination to sit, the chickens are hardy, and unlike those of the Spanish, they feather quickly and mature rapidly. He fully endorses all that American breeders hold to be excellent in these admirable fowls.

BROWN LEGHORNS.

LEGUMEN, LEGUME. A pod like that of the pea, bean, etc. A one-celled, one or many seeded, two-valved, superior, and commonly dehiscent fruit.

LEGUMIN. The caseine of leguminous plants.

LEGUMINOSÆ. An extensive natural family, very important in agriculture, from yielding peas, beans, clovers, indigo, etc. The genera are often immense trees in the tropics, as logwood, mahogany, but are usually small herbs in the North. The most remarkable characters are the presence of legumens with irregular, often papilionaceous flowers.

LEGUMINOUS CROPS. Crops of clover, beans, tares lucerne, and other leguminosæ. Some writers, however, very improperly allude to root and leaf crops under this term, imagining that all ameliorating crops should be called leguminous, as being distinguished from white or culmiferous crops, which also exhaust the soil.

LEICESTER SHEEP. Originally the Leicester Sheep were large, coarse, heavy, poor in flavor as to the meat, with long, thin, flat-sided carcases; large boned, long, coarse wooled, and poor feeders. Robert Bakewell in the last century, by selection and proper feeding and breeding, brought them into great celebrity, beginning in 1775. In 1780, it is recorded that his rams were let at fifty dollars each for the season's use; in 1784, at $525 each; and in 1786, one ram was let for $1,575. Subsequently seven were let for $10,500 for the season, and $2,200 was paid by each of two breeders for the use of a ram. Mr. Bakewell reserving one-third of the use of this ram for himself, making his yearly value $6,600. After his death, his successors not having the tact of Mr. Bakewell, the sheep declined, became delicate in constitution, and of late years they have become mixed with the blood of the Cotswolds. So far as we can learn the Leicesters have not held their own in the United States or in Canada. It is an open question, however, whether the Leicester might not be used in certain cases to refine the Cotswold, in the hands of breeders whose close study of anatomy and form, would enable them to breed them intelligently.

LEMON. A tropical plant of the citrus family, including the orange and citron. The lemon is not cultivated to any considerable extent; but in some of the Gulf States, notably Florida, oranges are largely cultivated. (See Orange, for the cultivation of the lemon).

LEMON, ESSENCE OF. The oil distilled from the peel, mixed with alcohol. The pure oil is termed the oil of lemons.

LEMON SYRUP. Lemon juice is kept with difficulty in bottles; made into a strong syrup, it is better preserved. The fluid sold by this name is often common syrup, acidulated with a little oil of vitriol.

LENITIVE. Medicines which gently soothe. A gentle purgative.

LENS. A thin solid, the faces of which are curved, and the general figure usually circular. The glasses of spectacles are lenses. Those lenses which have two convex or protuberant sides, or one side plane, magnify objects, and concentrate the rays of heat to a burning focus; hence they are termed magnifying or burning glasses. Concave lenses minify, and do not collect heat to a real focus. The name of the lens differs with the figure of the curved surface.

LENTICULAR. Shaped double convex lens.

LENTICELLS, or **LENTICULAR GLANDS.** The specks or knots on the stems of some trees, from whence, if in the soil, roots would proceed.

LENTIL. *Ervum lens.* A leguminous annual, similar to the vetch. It is much cultivated in France and some parts of Germany as food for man.

LENTOR. Viscidity, clamminess in fluids.

LEPIDOPTERA. Insects of the moth and butterfly tribe.

LEPIDOTUS, LEPIDOTE. Scurfy, scaly.

LEPISMA. A family of wingless insects, the bodies of which are covered with glistening scales, the feet short. They are very active, and found about old wool, and in dark, moldy places.

LEPRA, LEPROSY. A disease of the skin, which becomes rough and covered with scaly patches.

LEPTURA. A genus of longicorn beetles, of the family *Lepturidæ.* Head inclined posteriorly behind the eyes, or contracted at its junction with the thorax into a neck; thorax conical or trapezoid, narrowed anteriorly; elytra becoming gradually narrower; eyes rounded and entire, or, if emarginate, antennæ inserted before emargination.

LETHARGY. Drowsiness, morbid desire to sleep. It is sometimes a precursor of apoplexy, and calls for blood-letting if occurring in a full habit.

LETTUCE. *Lactuca sativa.* Lettuce is a hardy annual of which the original country seems to be unknown, but thought to be a native of Asia. It has been found wild in many different parts of the world, and was first cultivated in England about the year 1562. It is divided into two families, called the Cos and the Cabbage lettuces. The first, distinguished by an upright growth—was introduced from the island of Cos; and the second—the habits of which are somewhat indicated by its name—from Egypt. Our climate is not altogether favorable to the Cos family. The botanical term *Lactuca* is derived from *lac*, the Latin word for milk, in allusion to the milky juice which exudes from the stem when broken. This juice when the plants are young, contains but a small quantity of the narcotic principle; but it gradually acquires a strong, bitter taste, and becomes notably sedative. This property seems to have been known at a very early period, and a lettuce supper was thought highly conducive to repose. Lettuce can only be grown to perfection in a rich, mellow soil, and one cool and moist. Hence it is always best in the West, when started in a cold frame and transplanted to the open air as soon as danger of hard frosts are over. It may be transplanted when it has only three or four leaves, or when it has formed six or seven. For succession the seed may be sown in a warm border, and again in the open garden in rows twelve inches apart, allowing the plants to stand finally six inches apart in the row. When it is to be transplanted set the plants six inches apart every way, take out every other row as may be required for use, and again alternate plants in the remaining rows, allowing the plants to stand twelve by twelve inches, when, if the soil be rich enough and plenty of moisture be present, they will form handsome heads completely covering the ground. Among the cabbage lettuces, the White Silesian is the one generally cultivated, and all things considered one of the best.

LEVELER. (See Lawn.)

LEVELING. The art of discovering the level of surfaces, or how high one place is above another; in agriculture, the reduction of hills or mounds to a level or plain surface.

LEVELING STAVES. Straight rods, six or more feet high, and divided into marks at the inches, which can be distinctly seen at a short distance; in more delicate observations the staff carries a movable sight with a central mark, which is adjusted by an assistant, according to the signs of the surveyor, until the level line is reached.

LEVER. A bar capable of moving around a prop or fulcrum; leverage gained depends on the distance at which the power acts from the prop, and weight or resistance. The lever is the simplest mechanical power. Levers are of the first, second, and third kinds: in the first, the fulcrum is between the power and weight; in the second, the fulcrum is at one end and the power at the other, the weight being between them; in the third, the fulcrum and weight are at the ends, the power Intermediate; in this case there is loss of power, but gain in the rapidity of movement of the weight; the treadle of a lathe is an instance.

LEVERAGE. The advantage gained in power by using a lever.

LEVERET. A young hare.

LEVIGATION. The reduction of a solid to an impalpable powder with the assistance of water or other fluids; this may be done in a mortar or on a slab; the mixture is afterward diffused in water, and the light parts, which remain suspended some seconds, poured off and retained, the heavier portions being again triturated.

LEY. Grass land.

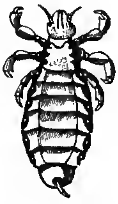
LEYDEN JAR. (See Electricity.)

LIAS. An argillaceous limestone of the secondary rocks; abundant in Europe, but unknown in the United States.

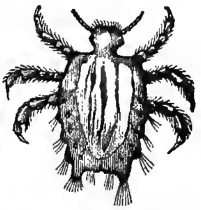
LIBELLULINES. A tribe of neuropterous insects like the dragon fly, which are found about water, and prey upon other insects.

LIBER. The innermost bark of trees. (See Bark.)

LICE. There are so many forms of these vermin infesting animals and plants, that an enumeration of the various species and a description of their habits would fill many large volumes, as various genera of plants and animals have their distinct parasites. Some plants and animals are difficult to keep clear of parasites, but as a rule, lice will not be found on either when in a state of perfect health. Snuff, tobacco-water, ashes, lime, soot, dust, and various other substances are employed to remove them. The best means of prevention however, is to keep the animal in perfect health, watching for the first appearance of the parasites. These usually are brought into flocks and herds by infested animals, and consequently when strange stock is bought, if thin in flesh, they should be carefully examined. The forms of lice in animals are many, each species however, having its particular forms. Human lice are of three principal forms. The head louse (*pediculus humanis*), the body louse (*P. vestamenti*) and the crab louse (*P. pubis*). The three forms are given below. Scab in sheep, mange and itch, are often attributed to lice. These are, indeed, caused by parasites which burrow under the skin, and may be destroyed by the same general means that will kill lice; that is by dipping in a decoction of tobacco-water to which flowers of sulphur is added. True lice, however, and ticks also, being confined to the surface and not under the skin may be destroyed by gentler means. On cattle, by an application of a preparation of lard oil and creosote, in the proportion of four parts of the first to one part of the latter. On horses, they may be clipped, and washed with a decoction of two ounces of powdered stavesacre seed in one quart of boiling water, applied cool, care being taken that the animal does not lick the wash, will be effectual. In mild cases, an ointment of two ounces of Scotch snuff thoroughly mixed with six ounces of lard will suffice, or one drachm of calomel and one ounce of crude petroleum, will not only kill the lice but allay the irritation. Hen lice are often irritating to horses. They usually congregate about the roots of the tail and mane. They are almost microscopic and hence not readily noticed. When found they should be eradicated with the last named remedy, and all parts of the stables whitewashed with lime, in which carbolic acid has been dissolved.


HEAD LOUSE.

BODY LOUSE.


CRAB LOUSE.

LICHENS. Plants of a very low organization, which grow on the bark of trees or rocks, where they form a kind of incrustation, or upon the ground, where they consist of irregular lobes, parallel with the earth's surface. Occasionally, in all situations, they are found in a branched state; but their subdivisions are generally irregular, and without order. Their fructification consists of hard nuclei, called shields, which break through the upper surface of the thallus or main substance of the lichen, are of a peculiar odor and texture, and contain the reproductive particles. Lichens abound in the cold and temperate parts of the world. The greater part are of no known use; but some, as the reindeer-moss (*Cenomyce rangiferina*), the Iceland moss (*Cetraria Islandica*), and various species of *Gyrophora*, are capable of sustaining life, either in animals or man. The Iceland moss, when deprived of its bitterness by soaking in an alkali and then boiling, becomes, indeed, a diet recommended to invalids. Others are used as tonic medicines, as *Variolaria faginea* and *Parmelia parietina*. Their principal use is, however, that of furnishing the dyer with brilliant colors; archil, cudbear and perolle, with many more, are thus employed.

LICHENIN. The starchy matter of lichens.

LIFE, ANIMAL AND VEGETABLE. Animal and vegetable life has been defined, by Auguste Le Comte, as resulting from a double molecular motion, general and continuous, of composition and decomposition, in relation to the organism and inorganic medium. This definition is correct enough as an hypothesis showing the action of life. What is life, is a question as yet too profound for the mind of man to elucidate. The action of life upon the medium has been defined to be as supposing not only a being organized in such manner as to permit the phenomena constituting the vital state, but supposes further the not less indispensable idea of the ensemble of external agents, physical and chemical, proper to furnish to the organism the principles necessary for its nutrition and the manifestation of the properties of its anatomical elements. This ensemble of conditions we name the medium. The idea of life and that of the medium are two conceptions so inseparable from each other that no life is possible in a medium improper for the accomplishment of organic phenomena. There must be a certain harmony between these two media. As this harmony diminishes, the phenomenon passes from the normal state to that of sickness or perturbation, a prolongation of which occasions death. Organic perturbation may occur in three different modes, which it is important to fully understand before proceeding to analyze the nature of the perturbation. Prof. Poey says: 1. If the medium is much more permanent, simpler, and more general, the living being alone is modified. 2. If the medium is much more unstable, more complex, and special, it is then more modifiable than the living being. 3. If the medium be as complex as the living being the modifications will correspond in both terms. In the capital question of the reciprocal influence of climatologic agents upon living beings, and *vice versa*, the problem to be first resolved by way of experiment is the following: To learn and separate, in meteorological observations, the sum of the actions of the medium, gravity, heat, light, electricity, etc., favorable for organic existence, from the sum of actions unfavorable for this existence, and, after this correction, to calculate the effects of action and reaction between the being and the medium. This problem having been formulated by Alphonse de Candolle, solely with reference to the influence of temperature on vegetation, was extended by Prof. Poey to all the other meteorological influences, by introducing the most capital element of the action of media upon living beings, and of their reaction upon media—a consideration overlooked by this savant. The persistent harmony between vital forces and external modifiers, which concur in the phenomena of life, being thus established in the theory of media, the last problem remaining to be practically resolved is the following: A living being and a medium being given, to determine their reciprocal influence. Such was the course pursued by Prof. Poey in examining those meteorologic and climatologic elements that exert any influence upon vegetable life, in its relation to the agricultural art. The principle of the correlation, conservation, and equivalency of heat and motion has been extended to all the forces both of organic and inorganic nature, and lately to the intellectual and moral functions. We thus identify all the forces acting in the living body with those acting in the inorganic universe, the former having only a higher degree of complexity. Hence the organic constitution (animal and vegetable) may be compared to an engine in which heat is the principal agent. The power of the steam engine is derived from the heat applied to its boilers, which heat is but the expression of the chemical changes involved in combustion. The same with vegetable activity, the force of the solar light being used up in the decomposition of the carbonic acid of the atmosphere by the growing plant. Combustion in the furnace of the steam engine is sustained either by wood which is the product of vegetation or by coal which represents the vegetable life of a remote geological epoch. In either case, therefore, we come directly or indirectly to solar radiation. But as Liebig says, our animated machines create no power, but only return what they have received from the external medium. In fact, Liebig defined life to be that plants live and grow; while animals live, grow, and feel. This, while as a rule being correct, is not so, strictly speaking, since it is not possible to verify the statement as to the lowest forms of life, any more certain than to state as a verity that vegetables do not feel. Some of the low forms of animal life seem to have no feeling, or indeed, power of voluntary motion. Some plants have the power of voluntary motion, as in the Sensitive plant, which immediately folds its leaves upon being touched; others again, as some of the acacias, fold the leaves at night and seem to sleep. Again, an animal may consist of a single cell, and in the lowest forms of life, there is neither muscular fiber, nervous filaments, head, heart, stomach, nor other organs common to most animals; they seem to live simply by absorption. Yet the absence of all these do not demonstrate that the substance is not animal. Albumen is the great nutritive element of animals, and starch of plants. So the chemical composition of the tissues of animals differs from that of plants. The basis of vegetable structure is cellulose, (see Cellulose,) and yet in the lower protozoa, cellulose is found; just as in some low forms of vegetable life, (fungi,) starch is deficient. Plants absorb and assimilate by their roots and leaves, and give off oxygen, retaining the carbon of carbonic acid, while animals digest their food, consume oxygen, and give off (respire) carbonic acid from the lungs. (See articles Generation and Germination.)

LIGAMENTS. Elastic fibrous textures uniting the bones together.

LIGATURE. A bandage. In farriery, a ligature is a fine, strong thread of silk, with which blood vessels, etc., are tied in operations.

LIGHT. Light is that natural force which, acting on the retina of the eye, produces the sensation of vision. Upon light, the continued vitality and growth of plants is dependent, and in its absence animals soon lose vigor, and at length their health is broken. In agriculture, the growth of plants is dependent upon the quantity of light received, and hence in seasons when the sun is much obscured by clouds, vegetation sensibly suffers. In the effort to produce seed, although if sufficient heat be present, the vegetation may be luxuriant, but will lack in vigor. The sun is the great source of light and heat, for so far as vegetation is concerned, both are necessary to successful growth. Besides the sun, all the planetary and starry systems give off light, but not appreciable heat, although some late experiments with delicate instruments would seem to show that appreciable heat was thrown back by the moon. Plants during light nights have been observed to grow faster than during dark nights, but experiments in this direction have not yet been carried forward sufficiently far to prove this beyond doubt. The principal phenomena and discoveries in the relation of light to vegetation, have been compiled by Prof. Poey, which will be interesting. The condensation of the principal experiments and facts are given below as follows: The paleness or whiteness of the parts of vegetables, when they are sheltered from the action of light, called by the moderns the etiolation of plants, did not escape the observing mind of Aristotle, who described it correctly enough, only he wrongly believed that the roots owed their paleness to their underground position; for they do not become green when exposed to light, and those which grow there are white. Still some roots are in themselves green, with or without the production of green matter or chlorophyl. The celebrated botanist, John Ray, first among the moderns, proved in 1686, by many experiments, that light alone exerts an influence upon the green color of plants, that they scarcely vegetate at all under an opaque vase, and that their stems become extremely elongated; this phenomenon was neither owing to the want of air, nor to the influence of heat. Charles Bonnet established that it was owing to the dark. Meese and Senebier analyzed the cause and the circumstances. Michellotti also first proved that light was injurious to germination, and Ingenhousz and Senebier found that seeds germinate more rapidly in the shade than in sunshine. After the tendency of stems to turn toward the light, three other phenomena were discovered at the commencement of this century relating to the influence of solar rays upon vegetation. Thomas Andrew Knight indicated for the first time in 1812 the tendency of some stems to shun the light in place of seeking it, and Dutrochet demonstrated it in the most incontestable manner. Dutrochet himself pointed out, in 1824, the tendency of roots to turn toward the light, and, in 1844, J. Payer discovered the contrary disposition in other roots to shun the light. After recognizing the action of natural and artificial light upon the growth of plants and the production of green matter, it will be interesting to study the influence of the different colors of the spectrum upon vegetation, by the aid of colored glass and liquids, and by the colored rays of the solar spectrum. Senebier, who appears to have been the first to take up this important question, published in 1783 experiments which he began seven years before, which were continued during four years. His conclusions are as follows: 1. The size of the stems and their whiteness are so much the greater as the plant's illumination is less; but the green color of the leaves does not follow this rule absolutely. 2. The highest illuminating rays, the yellow and red, do not give the leaves the most decided green tint; the violet ray produces this effect with the lowest illuminating power. Senebier draws the conclusion that the green color will be deeper when there is less light reflecting from the leaf and more penetrating it, and on account of this the violet ray gives the leaves a deeper green than natural light. 3. After the violet rays, plants become more developed in the red rays than in the yellow. By submitting plants to the action of light transmitted through glass of different colors, l'Abbé Tessier remarked, in 1781, that the intensity of the green tint of leaves went on decreasing from white glass to deep yellow; that leaves become sensibly green under the influence of lamps and of the light of the moon. He also observed that the stems are very strongly inclined when we place black materials behind the plant; the inclination is very feeble when the stuff is white; and it is almost nothing when we place a looking-glass behind the vegetable. Leaves which were placed behind a pane of white glass were green; less, however, than if the pot had been outside of the apartment. Leaves behind a pane of blue glass were still more green, there being between them and the preceding a sensible shade. Leaves behind a clear yellow pane differed from the last only by being a shade less green. In fine, the least geeen of all were those which had been placed behind a deep yellow pane; the differeuce was striking. In 1817, Dr. Sebastian Poggioli, instead of submitting plants to light transmitted through colored glass, conceived the happy idea of placing them under the rays of the solar spectrum. He observed, after the third day, that the smallest plant submitted to the violet rays, surpassed, in development, those under the influence of the red rays, the latter, on the fourth day, appearing to be blanched. The cotyledonous leaves of the plantlets in the two vases changed their positions and directed their upper surfaces one toward the red light, and the other toward the violet. The direction was more rapid with the plantlets submitted to violet rays than with those which had been submitted to red rays. The two cotyledonous leaves which crown the plantlets of *Raphanus rusticanus* directed their upper faces, in the first place, toward violet light, and in the second, toward red. The seeds of *Brassica eruca* germinate more promptly under the influence of red rays than under green rays, and more promptly under green than violet rays. In 1830, Adolphe Brogniart and de Jussieu saw the two opposite leaves which terminate the plantlets of *Alsine media* direct in the same manner their upper faces toward the red light to which alone they were submitted. Thus the phenomenon was the same as that observed twenty-seven years before by Poggioli. Brogniart remarks that he had observed, as had Charles Morren, that the yellow rays approached, in their action, nearer than any of the others to white light; but, as this depended upon the fact that yellow glass allowed a very large quantity of white light to pass through it, while green and blue passed but a little, and red glass none at all, the intensity of light differed extremely in all these experiments. In 1832, Charles Morren, by the aid of experiments with colored glass, reached the following conclusions: 1. That the colors of the spectrum, excepting green, only, like darkness, assist germination as their luminating power becomes less. 2. That under the colored rays of greatest illuminating power, the radicles develop least and slowest, and that the plumules, on the contrary, grow best and quickest. 3. That under the rays with low illuminating powers, the radicles and plumules develop as they do in the shade. 4. That, consequently, the etiolation of vegetables, under the prismatic rays, happens in inverse proportion to their illuminating property. 5. That the green color of vegetables is developed much more rapidly under the influence of composite light than under decomposed rays. 6. That the yellow rays possess the maximum, and the orange rays the minimum degree of coloring plants green, and the other rays do not turn them green at all. 7. That the yellow ray greens them more when it is less intense, but that it requires much more time to produce this effect than white light does, and that it can never produce the same depth of color. In 1837 and the following years, Dutrochet made a great number of experiments upon the influence of light on vegetation. None of the stalks of *Lepidium sativum* showed the least inflection toward light transmitted by red glass. At the end of eight days they had increased considerably in length, but remained straight and vertical. These observations completely confirm those of Payer upon the same plant. On the contrary, the stalks of *Alsine media* were, at the end of three days, all turned toward light transmitted through red glass. On turning the vase in such a way as to direct the inflection of the stalklets toward the base of the apparatus, four hours afterward they were bent anew toward the red light. Dutrochet then proved that this depended on the size of the stalklets of the two plants; that the only plants bent toward red light were those whose diameter was less than fifty-five hundredths of a millimetre; a tenth of a millimetre difference between the diameter of one stalklet and another of the same species, near a certain limit, sufficed to bend one toward the light, and leave the other in its natural position. The experiments of Dutrochet prove that the stalks of plants are bent toward red light transmitted without mixture by glass of this color; while, according to Payer, they inclined toward blue or violet light. Dutrochet here raises an important question, whether it is not the luminous intensity of the colored rays which determines the inflexion of vegetable stalks, an intensity varying with the transparency of the glass. The first flexion in the stalks toward the light is shown without exception in those submitted to the violet rays; afterward, in the indigo and blue rays, and ordinarily at the same time in the lavender rays which form the almost invisible continuation of the spectrum beyond the violet; then in the yellow and green rays, in the orange, and finally in the red rays. Beyond violet the flexion of stalks reaches twenty and sometimes even thirty centimeters, according to the intensity of the light; but beyond the red rays the flexion of the stalk extends very little. Previous to 1837, Dr. John William Draper, of New York, having made several experiments on the action of different rays of the solar spectrum, concluded that the yellow ray, the most luminous, had the power of producing chlorophyl. Plants become also green in light that has been submitted to the action of the yellow solution of bichromate of potassa, and so deprived of those rays which blacken chloride of silver; the same is true of light which passed through sulphocyanate of iron, and sulphate of copper and ammonia; in every instance the leaves becoming green. Seeds of common cress were caused to germinate and grow under these circumstances. It is not this or that ray, adds Draper, which gives rise to the color of beans. The absence of the chemical or the calorific ray does not appear to affect it, nor have we any direct proof that the calorific ray exerts any influence. Humboldt has stated that in the mines of Germany plants grow in recesses where the sun's light never comes, and, provided hydrogen gas be present, the color is green. In the abysses of the ocean, at depths to which no solar beam can penetrate, and where there is perpetual night, green plants are found flourishing. Light, which seems to act merely as a stimulus on the green organs of vegetables, indirectly bringing about the decomposition of carbonic acid, though accessory, is not, however, essential to the growth of plants. From 1840 to 1847 Robert Hunt was engaged in an extensive series of experiments on the process of germination and vegetable growth as affected by solar radiations. These experiments were undertaken under the auspices and at the expense of the British Association for the Advancement of Science. The results to which he was led are: 1. Light prevents the germination of seeds, as was formerly asserted by Michellotti, Ingenhousz, Meese, Senebier, and others. 2. Actinism, or chemical rays, quickens germination. 3. Light acts so as to effect the decomposition of carbonic acid by the growing plant. 4. Chemical action and light are essential to the formation of the green matter of leaves, or chlorophyl. 5. Light and chemical rays, independently of the calorific rays, prevent the development of the reproductive organs of plants. 6. The heat radiations corresponding to the extreme red rays of the spectrum facilitate the flowering of plants and the perfecting of their reproductive principles. As to the conditions in which the luminous, chemical, and caloric principles exist in light during the different seasons, he has found that—in the spring, chemical action is the most powerful, and is in very considerable excess of pure light and heat. As summer advances the quantity of light and heat increases to a very great degree above chemical action. In the autumn, light and chemical action both diminish, and the calorific radiations predominate. These facts bear strikingly upon all Hunt's experiments; they appear to confirm his conclusions in a most satisfactory manner, and also to point to a singularly interesting order in nature, which is the following: In the spring, when seeds germinate, and young vegetation awakes from the repose of winter, we find an excess of the principle which imparts the required stimulus—that is of chemical action; seeds then germinate, and young buds and shoots are developed. In the summer this agent is counteracted by another possessing different powers, upon the exercise of which the formation of the plant's structure depends—that is luminous action. As the sun becomes more active the formation of woody fiber proceeds under this agency, and the chemical power is rendered less active by the purity of the light. Finally, in the late summer and in the autumn these are checked by another agency with diminished power of light, upon which the development of the flower appears to depend, the ripening of the fruit, and the perfection of the seed —and this is thermic action. The experiments of Hunt have also led him to detect some curious influences which appear due to dissimilar rays, and in their action exhibit great inconstancy of effect. One class of rays, the same to which Sir J. Herschel has given the name of parathermic rays, are so subdued by the influence of more refrangible rays, as to be nearly inactive during the spring and early summer months; indeed in the spring they scarcely produce any effect upon dead vegetable coloring matter, unless their action is assisted by the use of some decomposing agent such as sulphuric acid. These rays increase in power toward autumn, and to them appears due the browning of the leaf. In all his writings Hunt has repeatedly stated that seeds would not germinate under the influence of light, when deprived of that principle on which chemical change depends; and has declared as a law, that in its relation to vegetable life, light prevents germination. This statement has been decidedly objected to by Doctors Draper and Gardner, of New York. By numerous experiments Hunt also found that the chemical principle of solar radiation produces an acceleration of the germinating process, so that in every instance the seeds influenced by these chemical rays germinated in one-half the time required by the seeds placed in the dark. In ascertaining if the influence of the chemical rays was confined to the surface of the soil, or extended below it, he obtained the most satisfactory evidence, that under the rays which passed through blue glass, germination began at a depth below the surface, where it did not take place under ordinary conditions. In every instance germination through the agency of radiations, which had permeated the blue glass in less time, and to a greater depth in the soil than was possible in comparative experiments where the seed was exposed to the full influence of light and its associated radiations as combined in the solar beam. As to different colors of light, Hunt says, that if the young plant continues to grow under the influence of blue rays, it will for some time exhibit luxuriance and present in its earlier stages an appearance far superior to that of plants grown under other influences, or even white light. The leaves will be of a darker green, and altogether show external signs of vigorous health. Even in the earliest stages it will be found that the plants grown in the full sunshine, or under yellow or red media, representing the luminous and calorific principles, give a larger quantity of woody fiber and less water than those grown under chemical influence. Plants growing in the shade, in like manner, contain more water than those in full sunshine; hence, we can not infer that anything more than the deprivation of light influences the condition of plants in these experiments. He ascertained that as great a difference exists in the quantity of water found in plants growing in artificial shade, and plants of the same class growing unsheltered, under the ordinary conditions of sunshine. It is therefore evident that all those experiments, which have been made on the increase of grass crops by littering the fields with the boughs of trees and the like, are liable to the error alluded to; and it is questionable if the increased product of an acre is not principally due to water, rather than to any carbonaceous product; consequently the increase of the nutritive property is not in the ratio of the increase of weight. Hunt further observes that it frequently happens, when the media employed cut off a large quantity of light, and admit the chemical principle freely, that no formation of leaves takes place after the development of the plumule or first leaf bud; the ground stem, instead of solidifying, remains soft, and without increasing in diameter, extends to an enormous length. Nothing like this occurs under the influence of either light or heat. It would appear that this abnormal condition is due to the excitement of the chemical rays, acting possibly with great power upon the living principle in the roots, by which the elaboration of some organizable matter is produced, which they supply as food to the stem. As there is but little power to decompose carbonic acid, there is not the necessary supply of carbon to give rise to those stems and leaves which naturally form the primitive stem. That this is something like a true explanation is further proved by the fact, that in the practice of planting shoots, the use of blue media is highly advantageous. It appears to increase the tendency to develop roots, and it is satisfactory to learn that some gardeners have, without any knowledge of the cause, employed cobalt blue-glass to aid in the striking of cuttings. According to Senebier, plants decompose the carbonic acid absorbed by their leaves much more readily under the influence of violet rays than under any other. In his early experiments Hunt thought he had found the correctness of Senebier's opinion. Dr. Daubeny and Dr. Gardner both think that the decomposition of carbonic acid increases with the increase of light, and that it is more rapid under the influence of the yellow ray than any other. In the experiments of Hunt, by which the quantity of woody fiber increases with light, this agent seems to be essential to its formation. But Hunt explains this fact by saying that the decomposition of carbonic acid by plants under the agency of light is not a simple chemical operation, as has been supposed by some, effected by the chlorophyl, but the result of an exertion of the vital principle of the growing plant which requires the external stimulus of light to call it into action. Hunt seems to have discovered a capital point, to which he has not himself done justice, and which has passed entirely unacknowledged by other observers. It is that in all his experiments he has found that each variety of plants employed was influenced by different rays. Cress and mustard, for example, become green most rapidly in the green ray, mignonette in the yellow, and peas in the blue ray. He observes, however, that the influence was always most decided between the limits of the mean orange and the mean blue ray, and that it took it much longer to green plants in the red than in the blue ray. The importance of this discovery, should it be confirmed, will consist in showing the action of light upon plants to be identical with that of heat. If each plant, as we have seen above, possesses its own zero of temperature and requires a certain different degree in order to accomplish each of its physiological functions, in light the greening of the leaves or production of chlorophyl (and probably the decomposition of carbonic acid and the fixation of carbon) needs also the chemical action of a certain colored ray of the solar spectrum. The difference existing between each color of the spectrum being only a difference in greater or less velocity of vibration, and of properties purely relative, as in heat and light, each plant will be therefore chemically affected by rays of different colors. Hunt thinks that the manner in which the power of solar radiation is exerted on seed beneath the soil is not clear to us. We do not know whether it is a mere disturbance of something already diffused through matter, or in the seed, or an emanation from the sun. All which we are enabled to declare is that the germination of seed is more rapid under the influences of chemical rays, separated from the luminous, than it is under the influence of the combined radiations or in the dark. That the formation of chlorophyl is not directly dependent upon either light or chemical action, regarded as isolated principles, but on the action of both forces acting upon plants. It has been stated by Dr. Gardner, adds Hunt, that plants exhibit a lateral movement bending toward the yellow ray. This appears to be a mistake; plants under the influence of the red rays bend from the light but along the line of the ray; and those exposed to the most refrangible rays turn toward it, but still in the line of the ray. Now the plants which first become green, by careful treatment in this way, are those exposed to the rays between the mean green ray and the extreme blue. The action is continued eventually to the edge of the most refrangible violet below the yellow ray. No change is effected beyond the visible spectrum, notwithstanding the abundance of dark chemical rays; and the change is shown only where there is really the largest amount of light. He therefore concludes that the luminous rays are essential in producing the decomposition of the carbonic acid and the deposition of carbon, which is afterward, in all probability, continued with hydrogen under the influence of the purely chemical rays of solar light. Finally, Robert Hunt communicated a letter to the British Association at its meeting in 1853, from Messrs. Laws and Co., of Edinburgh, in which it was stated that by adopting the plan of cutting off luminous rays by the use of cobalt blue glass, as recommended by Hunt, they succeeded in obtaining healthy germination far more rapidly than in ordinary circumstances. They constructed a house glazed with blue glass, and in this their seeds were tested. The practical application of a scientific discovery was of the utmost value to them. Tropical seeds, under the same circumstances, were found to germinate in a few days, when in ordinary conditions many weeks were required for the process. According to l'Abbé Zantedeschi, Carradori had, in 1841, confirmed the results of Senebier, so far as that the power of light to color vegetables green, resides in an eminent degree in the violet and blue rays, although it is more feeble than in ordinary light. In 1843, J. Payer, by making use of colored glass, and afterward of the solar spectrum, found that the tendency of stems toward the light was so much greater as the light was less intense or reached a lower point. As the plant found between two luminous rays of different intensities is always curved on the side of the stronger light, between the blue and violet, the blue region has always the greater amount of this action, and in it is found the maximum. But Payer has not studied the action of invisible chemical rays beyond the violet, upon the flexion of the stems, as Guillemin has done later, although Hunt found no influence upon vegetation in the ultra-violet rays. Hence, Prof. Poey is also inclined further to believe that Hunt has not paid attention enough to the obscure and chemical rays. In 1842, l'Abbé Zantedeschi drew the following conclusions from his experiments upon the influence of solar rays transmitted by colored glass: 1. Vegetation under the influence of light transmitted by any kind of colored glass is languishing and sickly, as was observed by Senebier and Carradori. 2. The order observed for germination, under colored glass, is different from that observed by Senebier. 3. Violet light has a power little inferior to that of ordinary light to green certain vegetables, as Senebier has said: the balsam is in this condition, but it does not take place with *Oxalis multiflora*. 4. As to the vigor of vegetation it is no greater under violet glass than under yellow and red glass, as Senebier has observed. 5. Green light is less favorable to vegetation than red light. 6. The most vigorous vegetation for *Oxalis multiflora* takes place under blue glass. In 1844, Dr. D. P. Gardner, of New York, claimed to have settled the question beyond dispute, that the yellow rays produce chlorophyl in leaves, as Dr. Draper had first advanced; but he is in complete disagreement with Hunt and other experimenters. Here are his conclusions: 1. That chlorophyl is produced by the more luminous rays, the maximum being in the yellow. 2. This formation is due to pure light. 3. That the ray toward which plants bend occupies the indigo space in Fraunhofer's lines. 4. This movement is due to pure light as distinguished from heat and chemical action. 5. That pure light is capable of producing changes which result in the development of palpable motion. 6. The bleaching of chlorophyl is most active in those parts of the spectrum which possess no influence in its production and are complementary to the yellow rays. 7. This action is also due to pure light. In the same year, Robert Harkness, of England, objected to Gardner's conclusions, and made the following very judicious remarks, which were approvingly quoted by Hunt: If the absence of solar light is one of the conditions almost necessary for the germination of seed, one should not expect that ray in which the maximum of light is found, to facilitate germination; but on the contrary, according to Hunt, to retard it. If, again, the yellow ray is the operating cause by which carbonic acid is decomposed and chlorophyl produced, we should also expect that, so far from assisting in germination, it would exercise a highly injurious influence. We know that the presence of oxygen is necessary for the vegetation of seeds, also that this oxygen is absorbed, and by uniting with a portion of the carbon in the seeds reappears in the form of carbonic acid, a process the opposite of that which takes place when chlorophyl is produced. So if the decomposition of carbonic acid is owing to the yellow ray, this ray ought to be the last to produce any effect on the germination of seeds. Moreover, seeds, as well as fully developed vegetables, possess the power when deprived of light, of absorbing oxygen and evolving carbonic acid; and to this circumstance we must ascribe the effect of the blue ray shown by Hunt's experiments. In 1850, Cloez and Gratiolet advanced the opinion that the decomposition of carbonic acid by the green parts of plants with the aid of colored glass is at its maximum with colorless polished glass; next comes yellow glass, then colorless transparent glass, red, green, and in the last place blue glass. In 1852, J. H. Gladstone, in experimenting with peas, drew the following conclusions, in entire opposition to Hunt's experiments: The cutting off of the chemical rays favors the first germination of the seed, and this appears to be the principal, if not the only advantage obtained by burying the seed in the soil. The development of roots also requires the absence of the chemical ray, yet it does not go on to the greatest extent when all the solar influences are excluded, but is favored, rather than otherwise, by heat and luminosity. The first development of the plumule also proceeds best under the same circumstances; yet these are not the conditions which produce a healthy plant; If all the solar radiations are withdrawn, whether entirely or only to a great extent, the plants absorb much water and grow very tall, without developing secondary branches or many leaves. The whole force of these radiations, on the contrary, prevents or greatly impedes the growth of those plants under the circumstances of the experiments. The chemical force is the most antagonistic to the growth of the pea, and luminosity also militates against it; the heating rays are favorable. If the plant is fairly established, those radiations which are, comparatively speaking, devoid of light, but replete with chemical power, are the most suitable to a healthy growth. The influences which facilitate rapid growth are diametrically opposed to healthy development. Upon the question whether the yellow light stops germination by some specific action or merely by excess of light, Gladstone says that the yellow light did not at all interfere with germination in his experiments. In the case of wheat and peas it decidedly facilitated the early development of both root and plumule. He thinks that the yellow ray, however, has a specific action of its own, and that the yellow and obscured yellow give quite different results from those of any other glasses. On the whole, Gladstone's experiments are in accordance with Draper's. In one or two cases, the seeds exhibited a tendency to germinate more readily under a blue glass. In 1854, Robert Washington, in some experiments made on the influence of colored glass on the growth of plants in sea-water, found that red sea-plants grew best in cases whose light was allowed to pass through green colored glass, and that the brown and green confervoid growths were thus destroyed. The first observer, as far as I am aware, who studied the action of the ultra-violet or invisible rays of the spectrum upon vegetation, and according to exact scientific methods, was C. M. Guillemin. His first care was to vary the nature of the prisms which he employed, in order to turn to account the special transparency that each prismatic substance presented to rays of different refrangibility. He chose, for instance, quartz for all rays more refrangible than blue, rock-salt for the red and calorific rays, and flint for the mean rays of the colored spectrum. Heavy flint which he had also employed, is the most dispersive of all; but it absorbs in great part the calorific and ultra-violet rays, transmitting only the least refrangible of them. In a paper presented to the Academy of Sciences of Paris, in 1857, Guillemin reached the following conclusions: The ultra-violet rays determine the formation of the green matter of vegetables. These same rays effect the flexion of the stems more rapidly than the rays of the visible part of the spectrum. In a second paper to the same academy he acknowledged that in his first communication he had given as certain the first proposition, but that he had some doubts on the second; further researches, however, had fully confirmed both of these prior propositions. His conclusions are the same as those he afterward published in a third, more extended work. They are as follows: Young etiolated plants curve under the influence of all the rays of the solar spectrum; the least refrangible calorific rays or those of low temperature appear to form the only exception. The calorific rays less refrangible than the red, and the chemical rays more refrangible than the violet, present two maxima of action for the flexure of vegetable stems; intermediate colored rays determine, on the contrary, more actively than the preceding the formation of chlorophyl. In the spectrum obtained with a quartz prism, the limit at which the flexion of the stem ceases, passes beyond that of rays more refrangible than violet, indicated by fluorescent substances and iodide of silver. Lateral flexion extends beyond the red and violet extremes; its center is in the indigo rays; it is often produced in spite of screens which separate the different colored rays. The development of green matter has its maximum in the yellow; it diminishes slowly as it proceeds toward the violet, passes this limit and becomes *nil* in the last fluorescent rays. Blue, green, yellow, orange, and red rays turn etiolated leaves green more quickly than direct solar rays. The action of yellow is almost equal to that of diffused atmospheric light. Polarized rays appear to act at close intensities, like common rays. The principle of the identity of radiations, which already rested on the observation of a large number of physical phenomena, is here fully confirmed in the physiological order, by the analogy of the mode of action which the calorific and ultra-violet rays exert upon the flexion of stems and the development of green matter. Unhappily for these important researches, if we compare Guillemin's first conclusion with the eighth of his second note, we find a flagrant contradiction upon a question of the highest importance, the maximum action of the colored ray of the solar spectrum, under the influence of which the formation of the green matter or chlorophyl takes place. According to the first conclusion it is in the ultra-violet rays that this is produced, while in conclusion eight it is in the yellow ray, and even diminishes slowly proceeding toward the violet. Thus it is wholly the reverse of the first case. Such a contradiction throws a weighty doubt on the whole of these experiments. In the following paragraph we see that Prof. Henry agrees with Robert Hunt and Prof. Poey as to the noxious influence of light on the germination of seed: Germination can be carried on in the dark, and, indeed, the chemical ray which accompanies light retards rather than accelerates the process. Its office is to separate the atoms of carbon from those of oxygen in the decomposition of carbonic acid, while the function of the power within the plant results from the combination of these same elements. The forces are therefore antagonistic, and hence germination is more rapid when light is excluded; an inference borne out by actual experiment. In 1869, Dehérain proves that the evaporation of water by the leaves of plants takes place under conditions entirely different from those which regulate the evaporation of an inert body, as it occurs in a saturated atmosphere; that it is especially effected by light; and that the luminous rays efficacious in causing the decomposition of carbonic acid by the leaves, are also those which favor evaporation. The yellow and red rays, which have little action on photographic paper act with most intensity in causing the reduction of carbonic acid, while the blue and green rays decompose the chloride of silver, and have no action on the leaves. These experiments confirm the old observation of Guettard, that the hard and smooth upper part of the leaves evaporates the most water. Boussingault has shown that the greatest amount of carbonic acid is decomposed by the same portion. Prof. Poey concludes as follows: After the long series of experiments I have announced, and which each one should utilize for himself, I must formulate my own conclusion, which I advance only with the title of hypothesis until I have the means of submitting it to experimental test. I remark first, that these experiments have been performed after different methods, and are therefore not to be compared with each other. Some experimenters have made use of colored glasses, others of colored liquids or solutions, and others still of the solar spectrum. In these three methods the nature and action of the colored rays must have undergone modifications so various as to make the results very discordant. For example, the most of colored glasses are impure, because they allow white light and various tinted rays to pass besides those of their own proper color. Yellow and green glasses, which are usually too clear, allow a great amount of white light to pass. The thickness of glass, the density of liquids, and the composition of analyzing prisms, are points of the highest importance, which no one has taken into account, and which modify greatly the tints of colored rays. Another cause of error is, that each observer is contented with submitting the plant to the action of this or that colored ray, and not to each of the seven colors of the spectrum. In short, no observer except Guillemin, not even Hunt, conceived the idea of studying the influence of invisible rays beyond red and violet, which afford the first, the maximum of calorific action, the second, the maximum of chemical action. These are errors of method only, without counting the personal errors of experiment, or even the errors which could result from the physiological and physical action of the plant. We have already seen in the case of Dutrochet, that one-tenth of a millimetre's difference in the diameter of two twigs of the same species was enough to bend one toward the light and the other away from it. In analyzing the action of light on vegetables, three great physiological acts of the plant must be considered: 1 The germination of the seed. 2. The decomposition of carbonic acid from the atmosphere and the fixation of carbon by nutrition in the tissues of the plant, which results in the formation of chlorophyl. 3. The flowering and fructification. In germination, according to Theodore de Saussure, we should distinguish two periods, the one during which oxygen is transformed into carbonic acid, which is the period of germination, properly speaking; the other during which carbonic acid is decomposed and oxygen is exhaled, which is the commencement of vegetation. The green color in which the plant clothes itself is the index and the consequence of that function which takes place only under the action of light; in its absence the plant continues the phenomena of the first period of germination without development, and remains colorless. If the physicists who have studied the influence of light on germination had taken the chemico-physiological action which it wrought in the plant more into consideration, they would not have committed another grave error, as Gladstone has done, in saying that the yellow rays, which possess the maximum of luminous power, and by consequence the minimum of chemical force, could in any manner favor the germination of seeds. The physicists who sustain this opinion have not sufficiently distinguished germination from vegetation, properly speaking. During germination the plant loses the carbon furnished by the carbonic acid, and only respires. On the contrary, during vegetation the plant retains the carbonic acid, fixing the carbon and drawing in oxygen, and therefore the functions of nutrition and assimilation of plants do not really begin till the moment of the appearance of green matter. The relations of plants and light are altogether different during the two periods; injurious during the period of germination, light is, on the contrary, indispensable in the second period of vegetation. It is for this the plant seeks always after light. Its shoots cling toward the side of incidental rays and inflect themselves constantly in that direction. It is a phenomenon general in plants, from the phænogamia to the cryptogamia, and in microscopic vegetation. Light is as indispensable to the nutrition of plants as the gastric juice is to digestion and the transformation of food. The assimilation and fixation of carbon in plants is greatest and most rapid when, all other things being equal, the supply of light is greatest. In the light of the solar spectrum, besides the special property of the seven colors which reduce themselves to three primary ones, three forces also are found intimately combined and working simultaneously. These are the luminous, the calorific, and the chemical force. Each one of these three great powers acting diversely on inorganic matter, there is no reason why they should not act equally after their nature on organic matter, whose chemical elements are the same. In fact, modern chemistry conclusively demonstrates that the vegetable, like the animal kingdom, is formed of but four elements, carbon, oxygen, hydrogen, and nitrogen. These four elements being combined in the most diverse and variable relations, it results that an innumerable quantity of organic components enjoy properties most distinct. On the other side, these four simple bodies are precisely those which constitute the atmospheric air. We can say with Dumas, that the whole vegetable kingdom is only the air condensed, and that it forms a vast apparatus of reduction. The base of these vegetable productions is always the same, the atmospheric air; the arrangement of molecules and their number is all which varies for constituting that mysterious force which one commonly calls life. From these considerations we establish hypothetically—1. That it is the purely chemical rays or ultra-violet with the aid of a certain quantity of obscure heat found mixed with the rays, which penetrate the vegetable stratum of the soil and determine the germination of seeds. 2. It is the purely luminous rays of the spectrum, the yellow, which determine, principally by the leaves, the decomposition of carbonic acid from the atmosphere and the roots, the fixation of carbon and the production of chlorophyl, and which explains the spontaneous and natural tendency of the plant to the light. 3. It is the purely calorific or ultra-red rays which determine the two physiological acts of flowering and fructification. Now the blue and violet rays on one part, the green on another, and the red rays have a purely secondary action in the production of these three great physiological acts of the plant, as the chemical, luminous, or calorific actions predominate in the second place. But it must be remembered before all that what we call the vital force proper to the plant precedes and modifies at will the three actions of the solar rays, chemical, luminous, or calorific in all the physiological acts of the vegetable kingdom. If this is true, we see at once the application to be made to agriculture and horticulture. First, in the arrangement of greenhouses, which leaves much to be desired at present. They should have compartments covered with pure glass, whose maximum chemical, luminous, and calorific properties would be more advantageous to each development of the plant. For example, in germination the glass should have chemical properties of the highest degree. For coloring the leaves and giving growth to the plant, glass should have the maximum of light; for flowering and fructification, the maximum of heat. As for the colors of the spectrum, the blue-violet, the yellow, and the red will yield the most advantage in these physiological acts of the plant. In general practice, however, these conclusions of Prof. Poey have not been found applicable, and yet in certain cases, especially in the case of plants requiring peculiar conditions, they are worthy of consideration. A few years ago prominent individuals, apparently jumping to conclusions, advocated the adoption of blue glass indiscriminately and as a means of securing health to invalids as well as plants. It resulted in a great sale of blue glass, but the great results not coming about that was expected, the sale soon ceased. The glaziers, however, made handsomely by the sale. The experiments here collected will show the facts in the case. (See Chemistry, Agricultural.)

LIGHTNING. One of the visible exhibitions of electricity. It occurs in several characteristic states, as, sheet lightning, or the reflection of invisible lightning on the clouds, in direct and zigzag lightning, and in what appears to be balls of fire, occasioned it is supposed by extraordinary accumulations passing through a conducting medium. (See Electricity.)

LIGNEOUS. Wood like.

LIGNIN. The pure fiber of wood divested of starch and other impurities; according to Payen, it consists of an investing or cellular matter, cellulose, isomeric with starch. Fine linen from hemp or flax is insoluble in water, decays very slowly, and is converted into dextrine by the action of dilute sulphuric acid and heat, and finally into starch sugar.

LIGNIPERDOUS INSECTS. Those insects which bore into or otherwise destroy wood.

LIGNITE. A kind of partially formed coal, in which the wood structure is distinct. It belongs to the secondary formations.

LIGULA. An appendage of the sheathing petioles of some grasses. The lower lip or labrum of insects.

LIGULATE. Shaped like a riband. The outer florets of some composite flowers are called ligulate.

LILAC. *Syringa.* A well known hardy shrub found in almost every garden, and of two principal colors, the lilac, and white. *S. vulgaris*, is the more common variety. *S. Persica*, is more profuse in its flowering; and in some respects is the better of the two species. It has been used for hedging occasionally. It will not form a protection against stock, but it holds its green color and bears the shears well. It is hardly to be recommended where either arbor-vitæ or privet will stand.

LILIACEÆ. A family of endogenous plants, remarkable for their brilliant flowers, including the lilies, hyacinths, tuberoses, etc. They are characterized by six petals, six stamens, superior ovary, anthers bursting inwardly.

LILIACEOUS. Flowers resembling the lily.

LILY. A class of superb flowering bulbs, or perennial plants, the most of them either hardy or surviving the winter in the North, under a good protection of mulch. There are many species, including the white lily, *L. candidum;* Martagon, *L. martagon;* tiger, *L. tigrinum;* orange, *L. aurantium*, and the bulbous, sorts, *L. bulbiferum.* The sorts named are all hardy and common. The Japan lilies contain some magnificent specimens, as for instance, *L. auratum*, the splendid gold banded lily. These may be left out over winter under a protection of mulch, and will make a profusion of magnificent bloom. The half hardy sorts require to be taken up in the fall and kept over winter in half moist sand. The hardy sorts should be taken up every three or four years and replanted. For pot culture of the tender sorts, they should be removed from the pot only when they require repotting. That is when the bulbs become too close. The best soil is equal parts of peat, strong loam and fine sand. They should have pots of large size and the bulbs should be deep enough to allow the stem fibers to grow freely. They should never be repotted except when the bulbs are dormant, then they may be turned out of the old pots, and the drainage, potsherds, if any, carefully removed, so as to avoid injuring the fibrous roots, or shaking off the earth. Repot in a larger pot in proper soil, being sure the drainage is good. The varieties are propagated from seed and the small offsets. The lily hyacinth is *Scilla Lillia-hyacinthus;* the lily of the valley, *convallaria majalis;* the lily pink, *Aphyllanthes,* and the lilly-thorn, a *catesbea.* The day lily is a *Hemerocallis. Amaryllus,* a splendid and extensive genus of plants, mostly hothouse, are sometimes but incorrectly called lilies, the same may be said of the calla sometimes called Ethiopean lily.

LILY, AMERICAN WATER. *Nelumbium luteum.* The sacred bean. It bears the largest flower in the Northern States. The beans are edible. *Nymphæ odorata,* of botanists, or sweet scented nymph, is the large double-flowered water lily of our ponds and sluggish streams, and altogether the most interesting of our aquatic flowers. While the yellow nelumbo is interesting as being the only American representative of the sacred lotus of the Egyptians, the white pond lily will always be regarded for its rare beauty and fragrance. As we go South it increases in size and beauty, but may be grown North in ponds that do not freeze to the bottom, and the water is not more than five or six feet deep, wherever the Concord grape will ripen.

LILY, DAY. *Hemerocallis fulva.* This has been recommended as an herbage plant. It is perennial, stands the summer well, and cattle are very partial to the leaves. It yields abundantly.

LILY OF THE VALLEY. *Convallaria majalis.* Sheep and cattle browse on it. Propagated by parting the perennial root.

LILY, YELLOW WATER. *Nupar lutea.* Common in ditches and ponds, bearing a yellow flower.

LIMACIDÆ. The family of slugs and snails.

LIMB, LIMBUS. The flat or extended portion of the petal.

LIME. What is generally understood by the term lime is quicklime, the protoxide of calcium, produced by burning limestones or sea-shells in the free draft of a fire. The process of calcination, drives off the carbonic acid contained in the limestone. If fresh burned lime be kept from access of air and moisture it will retain its condition unchanged. Its affinity for moisture, however, renders this difficult. Quicklime does not absorb carbonic acid from the atmosphere until it has first absorbed moisture. It then absorbs carbonic acid, and becomes a combined carbonate and hydrate of lime. For agricultural uses, lime is used air-slacked, after being burned, in which state it is a fine powder. Its mechanical action is to render heavy soils more porous, and light soils more tenacious. It does not act chemically on soils when freshly burned, and hence it is often mixed with three or four times its bulk of earth and spread upon the surface of the land. The weight and exceeding fineness of lime causes it to sink in the soil, hence it should always be applied near the surface. Lime is not a manure. It does not bring plant food to the soil, but assists that which is there for vegetable nutrition. It produces physical conditions enabling plants to assimilate the nutrition already in the soil. Hence the effect of lime on rich soils deficient in lime, and hence also the fact, that lime should not be used except in connection with other fertilizers, since one of the principal actions of lime is to convert insoluble matter of the soil into available plant food. Sometimes its effects are surprising upon worn soils. In this case it may be inferred that the fertility was then but locked up in an insoluble condition, a not by any means uncommon state of things. Hence the well known adage that, the only way to know if land wants lime is to try it. Theoretically a soil should contain three per cent. of lime, in connection with the percentage of vegetable matter and other plant food. The following table shows the amount in tons necessary to add from one-quarter of one per cent. to four per cent. of lime as it comes from the kiln, to a soil at the varying depths three, six, nine, and twelve inches in depth.

Tons.	3 inch. per cent.	6 inch. per cent.	9 inch. per cent.	12 inch. per cent.
4 tons give.....	¼	⅜	½	1
8 " " ...	½	¾	1	2
12 " "	¾	1	1½	3
16 " "	1	1½	2	4

The quantity generally applied is from four to twelve bushels per year, or from twelve to fifty bushels every three years. Lime is always found in plants, not as pure lime but chiefly as the carbonate, phosphate, or sulphate of lime, that is in combination with acids. Therefore, when it is found that a soil does not contain three per cent. of lime, it should be added. Prof. Way has determined the amount of lime in various plants; in 100 parts of the ash of the following plants, he found:

Of the grain of the creeping wheat....................	6.76
Of the straw and chaff..	7.46
Of the grain of chevalier barley..........................	1.48
Of the grain of potato-oats..................	1.31
Of the chaff of oats..	8.65
Of the grain of rye..	2.61

It is recorded as noticeable that the amount of lime present in the ash of various specimens of wheat was the most considerable—8.21 per cent. in some Hoptoun wheat grown on silicious sand, and that in another specimen of the same wheat grown on a chalk soil, the ash only contained 1.83 per cent. of lime. In the ash of various green crops, Prof. Way found, in 100 parts, the following amount of lime:

	Parts.
Red-clover hay..................................	35.02
White clover hay..................................	26 32
Sainfoin, (in flower).........	24.30
Sainfoin, (in seed)..................................	29.67
Italian rye-grass, (in flower).........	9 95
Italian rye-grass, (in seed).........................	12.29
Flower of hope, (mean of three specimens)......	19.33

The amount of lime in the red and white clover did not vary in different specimens grown on silicious or clay soils. It would have been reasonable to expect a large proportion of lime in the sainfoin, which flourishes best in a calcareous soil. The specimen, however, analyzed by Prof. Way was grown on a light gravelly loam, with a subsoil of gravel above chalky clay. In a ton of the ordinary roots and legumes (the entire plant) Prof. Way found the following amount of lime:

	Pounds.
Turnip	3.70
Mangold	0.87
Carrot	8.24
Kohl-răbi, (bulb)	10.20
Kohl-rabi, (leaves)	30.31
Peas	2.28
Pea-straw, (2,989 pounds)	86.80
Beans	2.75
Bean-straw, (2,270 pounds)	22.25

So that, as the professor remarks of the roots, twenty tons of bulbs and four tons of tops will require of lime:

	Pounds.
Turnips	90
Mangolds	21
Carrots	197

The ash of the various natural grasses was found by Prof. Way to contain from 14.94 per cent. (the *Phleum pratense*) to 3.94 (the *Alopecurus pratensis;*) in that of the artificial grasses he found from 45.95 per cent. (the *Medicago sativa*) to 13.40, (in the *Achillea millefolium*). It is noticeable that the amount of lime present in a plant varies considerably in its different portions. Thus, the ash of the *Kohl-rabi* contains 10.20 per cent. in that of the bulb, but 30.31 in the ash of the leaves. The ash of the root of the carrot yielded 5.64 per cent of lime, that of the leaves 24.04. The ash from the flowers of the hop 9.59 per cent., that from the leaves 30.73 per cent., that from the vine 23.71. The ash of the potato analyzed by Prof. Way contained in that of the tubes 4.50 per eent., in that of the haulm 29.86. The action of lime when applied to soils abounding in inert, organic matter, like the peaty, is not only to furnish a supply of lime to the plants which tenant such soils, but caustic lime tends to bring any dead vegetable matters which they contain into a state of decomposition, so as to render them more soluble in water, and so more available as food for growing plants. It is in this way that we account for the success of the mixture of lime with the scrapings of ditches, collections of weeds, pond mud, etc. This compound, after allowing it to remain in a heap for two or three months has been found to be a very useful manure, and acting quickly. It should be distinctly remembered that lime must never be applied as a part of the compost with fermenting manure, unless muck enough is used to take up the ammonia set free, since the effect of lime is not to fix ammonia, but to free it; to fix it, copperas or gypsum is to be used. This requires to be well remembered, for nitrogen is one of the most important and expensive in the whole category of substances necessary in the soil when maximum crops are to be raised.

The following analyses of six samples of lime will enable the reader to get a good idea of the constituents:

Constituents.	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.
	Pr. ct.	Pr. ct.	Pr. ct.	Pr. ct.	Pr. ct.	Pr. ct.
Lime	74.23	69.76	79.87	88.44	86.97	89.93
Magnesia	2.44	12.12	.66	.51	3.35	2.15
Alumina and iron oxide.	1.50	6.44	2.85	6.18	4.55	5.77
Residue, insoluble	3.93	2.80	.09			
Water and carbonic acid	17.90	8.88	16.53	4.92	5.13	2.15
	100.	100.	100.	100.	100.	100.

An analysis of hydraulic limestone gave the following results: Insoluble in acid, 27.49 per cent., consisting of:

	Per cent.
Silica	18.67
Alumina	6.23
Iron oxide	1.63
Manganese oxide	.64
Lime	.31
Soluble in acid, 72.51 per cent., consisting of:	
Lime	38.04
Magnesia	.60
Iron and alumina	2.92
Carbonic acid	.23
Phosphoric acid	26.27
Soda	1.56
Potassa	1.90
Water	1.00
	100.00

In agriculture lime assists in pulverizing the soil, by acting chemically upon the silicates therein, dissolving out a portion of the silica and liberating potash and soda. It is for this cause that lime tells so well on poor granitic soils. From 100 to 600 bushels to the acre are used; wet, stiff lands, and those destitute of calcareous matter, requiring most. Lime corrects injurious substances in the soil, as sulphate of iron, etc. For this purpose a heavy dose is required. Lime breaks up or pulverizes stiff clays, improving their texture. For this purpose a heavy dose of quicklime is most effective. It decomposes inert vegetable matter, as peat, roots, etc. The dose for this purpose may be less than above; thirty to 100 bushels will be enough, if lime has been previously employed; but on peat lands, well drained, much more is necessary. Lime is found in large quantities as an ingredient in leguminous plants, potatoes, and other roots; hence it may be added as a special manure to such plants, three or four bushels being placed in the manure used for them. It hastens the decay of stable manure and putrescent substances and may be sprinkled over them when plowed into the soil, but not allowed to be added for any length of time to heaps of manure, for it drives off any ammonia already formed, and ultimately reduces the action of the dung. One bushel to three or four loads will be enough. A first liming for improvement of barren lands may be heavy; but if afterward a dose of twenty bushels to the acre be added every four or five years, it will save a very heavy addition for some time. Quicklime would be the best to add as an amendment, but it is difficult to handle, from its causticity and must never be added to wet soils, lest it convert them into a hard mortar. On the whole, therefore, water-slacked lime is the most useful. Air-slacked lime is used as a top-dressing to meadows, the other being too caustic; it is also employed to kill and annoy insects, which it does without injury to the plant. It is also added, in doses of a half to one peck, to the roots of fruit-trees, worked into the soil. The best kind of lime for the former is that obtained from burned shells, the common limestone usually containing magnesia, which, in a caustic state, is injurious to vegetation, from the slowness with which it becomes mild, so that it injures the roots of plants long after the lime has become quite mild. The older limestones, and especially those of a bright white, crystalline appearance, form the best lime. Lime is used in composts to pulverize inert vegetable matter, which it does very effectually, converting it in part into humate of lime; the action of the lime is similar to potash or soda, and termed by chemists catalytic, or predisposing. Lime-water and a cream of lime, made by mixing lime with water to the consistence of cream, are much used as a steep for seeds, and to wash the bark of trees, etc., to preserve them from insects; it is also supposed to preserve timber.

LINACEÆ. The family of plants to which flax belongs. They are remarkable for their mucilaginous seeds and tough fibers.

LINCOLN SHEEP. The Lincoln are considered as furnishing the best representative of nice combing wool in England, ewes shearing fifteen pounds per annum. It is also one of the largest of English sheep. The ewe of which a cut is given girted six feet, weighing alive 364 pounds, and when killed dressing sixty-seven pounds per quarter, dead weight. It is recorded that fourteen pounds average has been sheared, as a first clip, from a lot of thirty yearling, wether lambs, and which at fourteen months old averaged 140 pounds live weight. The Lincolns of the beginning of the century were large, coarse animals, with long, ragged, oily fleeces, the flesh of which however, was considered excellent. The sheep were inclined to make fat inside. Improvements in this breed of sheep have increased their value, both in flesh and wool. This improvement resulted through the use of Leicester rams, careful selection, and as careful feeding, and now it is celebrated for its long, lustrous and worsted wool, and in England has a separate class at the fairs. Like the Romney Marsh sheep they do well on rich alluvial soils and drained marshes, requiring plenty of rich succulent food and careful attention. These sheep have been introduced into the United States, West, and into Canada, where they are reported so far as doing well, but it will require some further time to fully establish the fact of their adaptability to our continental climate. This, however, would seem to be probable, since other of the long-wooled sheep do well on our flush summer pastures, and also on our winter food, which is principally composed of hay and grain, neither white nor Swedish turnips doing well in our hot summer climate. Our climate however, is well adapted to beets, carrots and parsnips, which may be very properly substituted.

LINCOLN EWE.

LINDEN. *Tilia.* The American linden, *T. Americana*, is one of our most majestic and beautiful shade trees, and in those sections of country where pine is scarce, it supplies the place of this tree in its lumber. It is generally known as bass-wood, linden, or linn. It is common in all the Northern and Middle States, and the northern Mississippi valley, an allied species *Tilia heterophylla* succeeding it as we go South; the latter larger than the Northern species in its leaves and flowers, and smaller in the size of the tree. Both species produce seed freely, which ripens in the fall. For planting they should be saved over winter in moist sand, or sown immediately. If not carefully kept they are difficult of germination. The European linden has a denser foliage than the American species, but it casts its foliage early, and does not seem adapted to the Western prairie soil. When it succeeds well it is the better tree for shade. The American species is good enough and should be planted more freely than it is. The cut shows one of the ornamental forms—the White Weeping Linden.

WHITE-LEAVED WEEPING LINDEN.

LINEATE, LINEATUS, LINEAR. Leaves, etc., which are narrow and of the same width throughout.

LINE OF DIP. In geology, the inclination of strata from the horizontal line; it is estimated in angles, and the direction of the dip toward the point of the compass given.

LINGUA. A tongue. In entomology, an organ placed within the labium, and serving the office of a tongue. Used also to designate the speech of a country.

LINGUATE, LINGUIFORM. A thick leaf, etc., shaped like the human tongue.

LINIMENT. In farriery, a semi-fluid ointment, or a soapy application to rub upon painful joints. The term is also applied to spirituous and other stimulating applications for external use. Liniments are intended either to lubricate or to stimulate; but in either case they can only be regarded as topical applications, their influence not extending beyond the part to which they are applied. In some instances they are anodyne, and contain solutions of opium in oil.

LINSEED. (See Flax.)

LINSEED JELLY. Is easily made by adding to six quarts of water one quart of linseed, boiling it for ten minutes. This mixed with other substances, is sometimes given to live-stock as food, and, mixed with milk, is very nutritious for calves.

LINSEED MEAL. Ground linseed.

LINSEED OIL. Is an excellent purgative—for sheep, from two to three ounces; for horses, in doses of from sixteen to twenty-four ounces; for cattle, from sixteen to twenty ounces. The quality of linseed oil may be determined in the following manner: Fill a vial with it, and hold it up to the light; if bad it will appear opaque, turpid, and thick; its taste is acid and bitter upon the tongue, and it smells rancid; and strong oil, from fine full-grown ripe seed, when viewed in a vial, will appear limpid, pale, and brilliant; it is mellow, and sweet to the taste, has very little smell, is specifically lighter than impure oil, and when clarified dries quickly and finely.

LINT. The staple of flax, hemp, and other textile plants. The scrapings from pieces of linen, of great use in dressing wounds and stopping slight hemorrhages.

LINTEL. A horizontal timber or stone over a door, window, or other opening, which sustains the weight above.

LIP. *Labellum.* In botany, the divisions of a monopetalous corolla, as the sage, mint, etc. It is divided into an upper and lower lip.

LIPPED AND HARLED. A wall built without mortar, but afterward having the joints filled with mortar, and the whole rough-cast or harled.

LIQUEFACTION. Melting, fusion, converting bodies into the fluid state, solution.

LIQUID MANURES. Manures applied in a soluble state, especially the stable wash. They are of especial service to produce rapid growth in young plants, and for steeps. In very dry seasons manures may also be applied in this state; but when added any length of time before the plants get size there is a loss by drainage; and the expense of application must always be heavy. The liquid soaked into peat, charcoal, etc., and added, as a top dressing, during moist or wet weather appears to be much preferred in the United States, and to be more economical. (See Manures.)

LIQUOR AMNIOS. The fluid surrounding the fœtus in its mother's womb. In botany, a fluid contained in the nucleus of the ovule, and supposed to nourish the embryo. It is absorbed during the ripening of the seed, sometime leaving behind a delicate sac only.

LIQUOR AMMONIÆ. Solution of ammoniacal gas in water.

LIQUORICE. *Glycyrrhiza glabra.* A half-hardy, herbaceous, perennial plant, cultivated for its roots, of which the well known form of glucose called liquorice is made, by extracting the juice and boiling. An American form of this plant, *G. lepidota,* is found in the Northwestern States and in Alaska, and is eaten by the Indians. The liquorice of commerce is obtained by slicing the roots and boiling in water. The liquor is then strained and evaporated to a proper consisteney. It is refined by redissolving, purifying, and again evaporated, and formed into quill-sized rolls. It is used somewhat in medicines, and by brewers and confectioners. The cultivation of the root was introduced into some of the Middle and Southern States some years ago, but the results did not prove profitable.

LIQUORICE, WILD. *Galium circæzans.* The leaves have the taste of liquorice.

LIQUOR OF FLINTS. A solution of silicate of potash, made by fusing three parts carbonate of potash with one of sand.

LIRELLA. In lichens, a linear shield, with a furrow in the center.

LITHARGE. An impure fused protoxide of lead. It is used for some plasters.

LITHIA. A rare alkali, resembling potash. It corrodes platinum.

LITHIC ACID. Uric acid.

LITHIUM. The metal of lithia. Lithia is the protoxide.

LITHOLOGICAL. Relating to the structure, characters, etc., of minerals or stones.

LITHONTRIPTICS. Remedies which dissolve stones in the bladder. An abundance of water acidulated with cabonic acid is the best.

LITHOTOMY. The operation of cutting through the perinæum into the bladder to extract a stone.

LITHOTRITY. The operation of introducing an instrument into the bladder through the natural passage, to crush and break to small pieces a stone.

LITMUS. Turnsole. A blue color prepared from a lichen (*Rocella tartarea*), and used in the arts (*archil*) and in chemistry. Solution of litmus, or paper stained thereby, is of great use in detecting acidity in a fluid, the blue changing rapidly into red by the acid. Alkaline mixtures restore the paper so reddened.

LITRE. The French standard measure of capacity in the decimal system. The litre is a cubic decimetre; that is a cube, each of the sides of which are 3.937 inches; it contains 61.028 English cubic inches, and is, therefore, rather less than our quart. Four and a half litres are a close approach to the imperial gallon.

LITTER. The straw, weeds, or other dry substances which are placed under horses and cattle in the stables, cow-houses, farm-yards, piggeries, etc., for the purpose of keeping the animals clean and warm, and providing a supply of manure. In this last view all sorts of dry materials should be carefully collected and stacked up for winter use.

LITTORAL, LITTORALIS. Of the seashore. Littoral formations, in geology, are such as have evidently been ancient sea beaches.

LIVE OAK. *Quercus virens.* Evergreen swamp oak.

LIVER. A large gland or viscus, placed in quadrupeds, on the right side of the body, immediately under the chest, and adjoining the stomach. It is saturated with blood-vessels, and separates the bile from blood. The bile is stored up in a small bag, called the gall-bladder, and thrown from hence, during digestion, into the small intestines, to be mixed with the chyme. The function of the liver is of the first consequence to health; but it is readily impaired, especially in damp foggy places, subject to ague and bilious fevers. Its action, when insufficient, rapidly stimulated by the use of calomel. Jaundice and yellowness of the white of the eye indicate disturbance of the liver.

LIVER FLUKES. (See Rot in Sheep.)

LIVER OF SULPHUR. A brownish substance, of a fœtid smell. Fused sulphuret of potassium.

LIVERLEAF. LIVERWORT. *Hepatica Americana.* An herbaceous, perennial rooted plant, of small size, found on the skirts of woodlands. A decoction used to be considered a specific and was prescribed in coughs.

LIVE STOCK. A term used to designate the animals usually kept on the farm; of these, cattle and horses are first in importance, then swine, mules, and sheep follow in respect to money value. The tables given will show the number of horses, mules, cows, other cattle, sheep, and swine in the United States, the average price, the value of each class and the total value as taken from the government statistics:

	Number.	Average price.	Value.
Horses	9,735,300	$64 96	$632,446,985
Mules	1,414,500	75 33	106,565,114
Cows	11,085,400	28 89	320,346,728
Other cattle	16,785,300	19 04	319,623,509
Sheep	35,935,300	2 60	93,666,318
Swine	25,726,800	6 80	175,070,484
Total	....	....	1,647,719,138

In the raising and preparing and transportation of live stock for market, and fitting it for the consumer, the following may be held as a fair exhibit of the real status of the business, from a business stand point, outside of the direct interests of the several persons and firms interested: Raising cattle is a copartnership business. The grower has one share, and the other must go to those who take the bullock off his hands, carry him to market, and slaughter and sell him. The largest item of expense is the transportation, as will be shown. While en route to market he is generally the property of the drover, who has purchased him from the grower, and who is the second factor in this trade. The drover looks after him while on the road, and sells him the first opportunity, provided he can make a fair profit. If no such opportunity occurs the bullock goes on to the seaboard, where he must leave the car and go into a yard. He has already had this experience, and had the cost charged to his account two or three times. This yarding costs forty cents a head. If the cattle are not sold immediately, and must remain over night, feed must be bought at a high price. The next operator who appears on the ground to make his profit and livelihood out of the cattle is the wholesale butcher, who purchases at the yards and either slaughters there or transports the animal by barge at an additional cost of forty cents to his own slaughtering establishment, from whence the quarters of beef, if designed for domestic consumption, are sent to the city

States.	Horses.			Mules.			Milch-Cows.		
	Number.	Average price.	Value.	Number.	Average price.	Value.	Number.	Average price.	Value.
Maine	79,400	$81 41	$6,463,954	....	....	....	164,300	$37 00	$6,079,100
New Hampshire	47,000	80 94	3,804,180	....	....	....	98,200	38 50	3,780,700
Vermont	74,500	83 24	6,201,380	....	....	....	209,500	33 70	7,060,150
Massachusetts	104,700	89 94	9,416,718	....	....	....	140,300	48 33	6,780,099
Rhode Island	14,700	97 87	1,438,689	....	....	....	20,400	39 00	795,600
Connecticut	51,100	82 14	4,197,354	....	....	....	110,900	43 33	4,805,297
New York	679,100	90 00	61,119,000	18,500	$98 35	$1,819,475	1,496,300	37 50	56,111,250
New Jersey	115,700	110 84	12,824,188	15,000	128 32	1,924,800	144,900	44 37	6,429,213
Pennsylvania	585,100	84 70	49,557,970	26,300	96 15	2,528,745	837,000	34 68	29,027,160
Delaware	19,600	83 45	1,635,620	4,000	95 00	380,000	23,000	32 00	736,000
Maryland	105,500	83 22	8,779,710	11,000	105 86	1,164,460	100,700	30 31	3,052,217
Virginia	194,900	69 53	13,551,397	29,800	85 60	2,550,880	227,000	22 77	6,168,790
North Carolina	139,700	74 97	10,473,309	51,700	82 54	4,267,318	201,000	15 48	3,111,480
South Carolina	56,900	88 58	5,040,202	44,700	94 07	4,204,929	159,300	19 75	3,146,175
Georgia	118,300	79 37	9,389,471	96,200	87 12	8,380,944	265,100	17 02	4,512,002
Florida	16,700	78 22	1,306,274	9,600	91 65	879,840	66,800	14 62	976,616
Alabama	104,400	71 36	7,449,984	101,400	80 20	8,132,280	168,200	20 27	3,409,414
Mississippi	89,100	76 04	6,775,164	96,100	97 07	9,328,427	174,600	21 03	3,671,838
Louisiana	76,300	58 78	4,484,914	79,900	83 96	6,708,404	89,600	20 71	1,855,616
Texas	770,400	33 17	25,554,168	110,700	53 59	5,932,413	500,100	15 72	7,861,572
Arkansas	158,900	54 09	8,594,901	83,400	67 50	5,629,500	160,900	16 20	2,606,580
Tennessee	318,000	62 64	19,919,520	101,900	67 82	6,910,858	225,700	20 83	4,701,331
West Virginia	111,900	59 44	6,651,336	2,400	68 08	163,392	125,500	25 77	3,234,135
Kentucky	364,700	56 94	20,766,018	85,000	58 93	5,009,050	244,700	27 94	6,836,918
Ohio	760,800	69 14	52,601,712	26,500	72 04	1,909,060	809,600	32 65	26,433,440
Michigan	296,900	82 31	24,437,839	3,800	96 12	365,256	361,100	33 70	12,169,070
Indiana	675,600	61 76	41,725,056	58,400	71 71	4,187,864	434,900	27 40	11,916,260
Illinois	1,091,700	59 75	65,229,075	111,100	71 37	7,929,207	717,800	29 05	20,852,090
Wisconsin	352,100	67 05	23,608,305	5,200	85 26	443,352	474,000	26 75	12,679,500
Minnesota	172,400	75 09	12,945,516	3,200	95 79	306,528	233,500	25 19	5,881,865
Iowa	685,800	63 83	43,774,614	37,000	82 21	3,041,770	621,800	26 90	16,726,420
Missouri	581,500	45 40	26,400,100	126,200	56 03	7,070,986	438,200	20 86	9,140,852
Kansas	227,300	49 63	11,280,899	20,700	64 40	1,333,080	235,700	23 76	5,600,232
Nebraska	67,900	69 42	4,713,618	4,600	98 00	450,800	59,700	28 09	1,676,973
California	209,300	45 46	9,514,778	19,400	77 20	1,497,680	363,800	31 46	11,445,148
Oregon	91,400	42 68	3,900,952	3,700	45 68	169,016	80,900	21 75	1,759,575
Nevada	10,900	54 00	588,600	1,100	78 00	85,800	9,900	33 00	326,700
Territories	115,100	55 00	6,330,500	26,000	71 50	1,859,000	290,500	27 50	7,988,750
Total	9,735,300	......	632,446,985	1,414,500	......	106,565,114	11,085,400	....	$320,346,728
Grand Average	....	$64 96	....	....	$75 33	....	....	$28 89	....

market, to be sold by a commission merchant at five per cent. commission. The retail dealer then carries them to his stall or shop, where they are cut up and sold by the piece to the consumer. So the grower has one share of the bullock for his part, and the consumer pays for that and the other share which is divided among the others. It is a close business; the drovers not averaging over one dollar per head for their net profits, and the wholesale butchers realizing from two to three dollars as their share of gain, with a heavy expense to come out of it, viz: The use of a large capital, buildings and appliances, and the cost of killing. The seller gets five per cent. with all risk of debts, etc., and the retailer cuts his meat and figures to sell at ten per cent. increase on the cost. It costs now in New York forty dollars to transport a hundred cattle from the railroad termini to the private slaughter-houses, as they all have to go by barges on the water; whereas they were formerly driven across the city on foot at an expense not exceeding two dollars. This is required by local law. There is but little probability of reducing the various expenses connected with the trade in fresh meat, unless it be possible to get rid of the speculative drover, whose fitful profits really average but little. He seems, after all, to be a necessity, as breeders are not used to the transit, dislike its risks, and will probably continue to sell to the drovers rather than to send forward their stock on their own account. Many cattle are sold by brokers at the yards, who charge a commission on their sales. This is an extra tax on the beeves, which the consumer pays. Cattle sent to Europe are purchased at the yards by the shippers, who select and slaughter their stock on the ground, and thus avoid some of the extra expenses which follow stock which are designed for home consumption. The wholesale butcher, in order to make his profit of two or three dollars per head, turns every part of the animal to account. Every thing possible is saved and sold for cash. The retail dealer must cut his profit out of one-third of the beef. If the balance can be made to bring cost he is satisfied. When the carcase costs nine cents a pound he must sell one-third in roasts and steaks at an average of eighteen cents per pound. One-fourth of a sheep can be cut into chops, which must be sold at eighteen cents and the legs of the hind quarters for fifteen cents, to make an advance of ten per cent. on the cost at eight cents per pound by the carcase, as the balance of the sheep will not sell for more than five cents per pound. The profits of dealers on a beef weighing six and one-half hundred pounds would be less than six dollars, and on a sheep weighing fifty pounds the advance would be but forty cents. These figures, of course, will vary, according to location, nearness to market, etc., but they will approximate nearly enough for all practical purposes. In fact, experience as a rule is simply the basis for calculation.—The following table shows the estimated number, average price, and value of oxen and other cattle, sheep and hogs, from government statistics:

STATES.	Oxen and other Cattle.			Sheep.			Hogs.		
	Number.	Average price.	Value.	Number.	Average price.	Value.	Number.	Average price.	Value.
Maine	201,900	$35 44	$7,155,336	525,900	$3 78	$1,987,902	58,800	$11 66	$685,608
New Hampshire	118,000	38 12	4,498,160	242,400	2 70	654,480	37,300	16 20	604,260
Vermont	130,500	29 33	3,827,565	490,500	3 74	1,834,470	51,800	12 19	631,442
Massachusetts	120,000	47 59	5,710,800	76,300	3 63	276,969	75,600	18 03	1,363,068
Rhode Island	16,000	49 72	795,520	25,300	3 96	100,188	16,300	17 05	277,915
Connecticut	114,100	36 68	4,185,188	92,500	4 18	386,650	57,900	16 73	968,667
New York	663,200	31 85	21,122,920	1,936,500	3 95	7,649,175	668,700	11 39	6,477,493
New Jersey	83,000	36 60	3,037,800	125,800	5 01	630,258	153,000	13 83	2,115,990
Pennsylvania	708,100	29 03	20,556,143	1,640,500	3 58	5,872,990	875,000	11 50	10,062,500
Delaware	31,700	24 72	783,624	23,600	3 67	86,612	46,700	10 61	495,487
Maryland	119,300	22 87	2,728,391	141,200	3 89	549,268	233,500	7 10	1,657,850
Virginia	397,500	16 86	6,701,850	356,400	2 93	1,044,252	689,800	4 45	2,624,610
North Carolina	313,200	10 19	3,191,508	283,900	1 58	448,562	758,300	4 01	3,040,783
South Carolina	186,700	11 69	2,182,523	142,700	1 81	258,287	275,900	4 11	1,133,949
Georgia	400,900	8 91	3,572,019	371,200	1 73	643,176	1,360,700	3 91	6,320,337
Florida	363,400	8 14	2,958,076	37,800	1 94	73,332	175,400	2 26	396,404
Alabama	327,300	12 79	4,186,167	185,900	1 93	358,787	755,900	3 99	3,016,041
Mississippi	307,100	11 85	3,639,135	151,800	1 81	274,758	792,900	4 31	3,417,399
Louisiana	171,900	11 68	2,007,792	68,800	2 04	140,352	222,600	3 98	885,948
Texas	2,343,700	9 57	22,429,200	1,691,400	2 00	3,382,800	1,090,000	4 09	4,458,100
Arkansas	261,300	10 62	2,775,006	192,400	2 01	386,724	901,200	3 91	3,523,692
Tennessee	323,700	12 19	3,945,903	341,700	2 11	720,987	1,026,400	5 22	5,357,808
West Virginia	235,200	21 63	5,087,376	544,500	2 55	1,388,475	248,400	5 38	1,336,392
Kentucky	389,600	21 14	8,236,144	683,600	2 85	1,948,260	1,604,300	5 51	8,8[illegible]9,693
Ohio	864,900	24 87	21,510,063	4,546,600	2 72	12,366,752	1,596,100	8 06	12,864,566
Michigan	410,000	26 35	10,803,500	3,450,600	2 65	9,144,090	469,700	7 93	3,645,421
Indiana	772,300	19 65	15,175,695	1,250,000	2 62	3,275,000	2,136,000	7 70	16,447,200
Illinois	1,287,000	21 54	27,721,980	1,311,000	2 41	3,159,510	2,640,100	8 63	22,784,063
Wisconsin	448,900	20 39	9,153,071	1,162,800	2 74	3,186,072	540,700	7 58	4,098,506
Minnesota	329,500	20 05	6,606,475	190,200	2 63	500,226	213,400	6 99	1,491,666
Iowa	913,200	20 91	19,095,012	1,663,900	2 66	4,425,974	3,296,200	8 08	26,633,296
Missouri	813,800	17 38	14,143,844	1,284,200	1 86	2,388,612	1,874,300	5 94	11,133,342
Kansas	486,200	18 95	9,213,490	123,900	2 80	346,920	246,500	8 91	2,196,315
Nebraska	86,900	20 76	1,804,044	48,900	2 77	135,453	80,900	7 58	613,222
California	1,076,000	20 08	21,586,000	6,750,000	2 02	13,635,000	363,300	7 17	2,604,861
Oregon	137,600	12 75	1,754,400	710,500	1 99	1,413,895	181,600	4 41	600,415
Nevada	46,700	21 00	980,700	20,900	2 60	64,840	6,200	9 60	46,800
Territories	786,000	18 78	14,761,080	8,049,200	2 80	8,537,760	116,600	8 75	1,019,375
Total	16,785,300	.....	319,623,509	35,935,300	....	$93,666,318	25,726,800	....	$175,070,484
Grand Average	....	$19 04	....	....	$2 60	....	....	$6 80	....

LIVE-STOCK MARKETS FOR 1879.

PRODUCTS.	January.	February.	March.	April.	May.	June.
NEW YORK.						
Cattle:						
Extra beeves.....cental	$10 25 to $10 50	$10 25 to $10 50	$10 50 to $10 75	$10 50 to $10 75	$10 50 to $10 75	....
Good to prime "	8 75 to 10 00	9 00 to 10 00	8 75 to 10 75	9 50 to 10 50	9 25 to 10 25	$8 25 to $9 50
Common to fair "	7 50 to 8 50	7 75 to 8 75	8 00	8 25 to 9 25	8 50 to 9 00	8 00 to 8 50
Poor to common "	....	6 75 to 7 50	....	7 00 to 8 00	....	6 50 to 7 00
Texas and Cherokee, cental...............	....	....	....	....	....	6 00 to 6 50
Milch cows........head	40 00 to 60 00	35 00 to 65 00	50 00 to 60 00	30 00 to 50 00	45 00	35 00 to 55 00
Veal calves......cental	2 60 to 7 50	2 75 to 7 50	6 50 to 7 50	4 00 to 6 00	2 50 to 5 00	2 75 to 6 00
Sheep............ "	4 00 to 5 00	4 00 to 5 50	4 87½ to 6 00	5 12½ to 7 00	4 50 to 6 50	3 50 to 5 75
Swine............ "	2 90 to 3 10	3 50	4 25 to 4 60	4 37½	3 80 to 4 00	3 70 to 3 90
CINCINNATI.						
Cattle:						
Fair to good shipping steers..........cental	4 00 to 4 75	4 25 to 4 75	4 25 to 4 75	4 50 to 5 20	4 50 to 5 00	4 00 to 4 50
Common to choice butchers' grades.....cental	1 25 to 4 00	1 50 to 4 35	2 00 to 4 50	2 00 to 5 00	2 00 to 5 00	1 75 to 4 40
Cows, heifers, etc. "	2 50 to 3 75	2 50 to 4 00	2 50 to 4 25	3 00 to 4 75	3 00 to 4 65	3 00 to 4 25
Sheep.............. "	2 00 to 4 50	3 00 to 5 25	3 00 to 4 75	3 00 to 5 25	3 00 to 5 00	2 50 to 4 25
Swine............ "	2 25 to 3 00	2 60 to 3 85	3 00 to 4 20	2 90 to 4 25	2 50 to 3 75	2 50 to 3 60
CHICAGO.						
Cattle:						
Extra beeves.....cental	4 60 to 5 00	4 75 to 5 25	4 80 to 5 00	4 85 to 5 10	4 85 to 5 15	4 80 to 5 10
Choice beeves.... "	4 10 to 4 35	4 25 to 4 50	4 50 to 4 70	4 60 to 4 70	4 50 to 4 70	4 65 to 4 75
Good beeves..... "	3 60 to 4 00	3 50 to 4 00	4 00 to 4 40	4 20 to 4 50	4 10 to 4 40	4 25 to 4 50
Medium grades.. "	3 00 to 3 50	3 25 to 3 50	3 75 to 4 00	3 85 to 4 15	3 85 to 4 15	4 00 to 4 25
Inferior natives . "	1 75 to 2 00	1 80 to 2 25	2 00 to 2 50	2 00 to 2 50	2 00 to 2 50	1 50 to 2 00
Texans.......... "	....	....	....	....	....	....
Veal calves....... "	2 75 to 4 50	3 00 to 4 75	3 00 to 5 00	3 00 to 5 00	3 00 to 5 00	3 00 to 4 75
Sheep............. "	2 75 to 4 25	3 00 to 4 60	3 25 to 5 00	3 75 to 5 75	3 50 to 5 75	2 75 to 5 50
Swine............ "	2 65 to 3 00	2 00 to 3 75	3 00 to 4 00	3 70 to 4 15	3 25 to 3 60	2 75 to 3 60
SAINT LOUIS.						
Cattle:						
Choice natives...cental	4 35 to 4 85	4 75 to 5 25	4 60 to 5 10	4 80 to 5 15	4 75 to 5 10	4 75 to 5 00
Fair to prime natives, cental...............	3 37½ to 3 85	4 00 to 4 55	4 20 to 4 35	4 65 to 4 80	4 25 to 4 70	4 25 to 4 70
Fair to good butchers' steers..........cental	2 75 to 3 50	3 60 to 4 00	3 85 to 4 00	4 12½ to 4 65	3 75 to 4 40	3 75 to 4 40
Common to good stock steers..........cental	2 60 to 2 65	2 25 to 2 75	2 00 to 2 90	3 25 to 4 00	3 00 to 3 75	3 00 to 3 75
Texans and Cherokees, cental...............	2 75 to 3 50	....	....	3 80 to 4 50	3 50 to 4 50	3 00 to 4 00
Sheep.............cental	2 00 to 4 25	2 25 to 4 75	3 50 to 5 50	4 00 to 5 00	3 00 to 4 70	3 20 to 3 45
Swine............ "	2 20 to 2 75	3 40 to 3 90	3 50 to 4 30	2 90 to 4 15	2 50 to 3 75	2 75 to 3 60
Horses:						
Plugs.............head	10 00 to 30 00	15 00 to 35 00	15 00 to 35 00	15 00 to 35 00	15 00 to 35 00	20 00 to 40 00
Southern horses... "	25 00 to 80 00	30 00 to 85 00	30 00 to 85 00	30 00 to 90 00	30 00 to 90 00	30 00 to 85 00
Streeters .... "	75 00 to 90 00	75 00 to 90 00	75 00 to 85 00	75 00 to 90 00	75 00 to 90 00	85 00 to 110 00
Heavy draft. .. "	90 00 to 190 00	95 00 to 190 00	95 00 to 190 00	95 00 to 190 00	95 00 to 190 00	100 00 to 150 00
Saddle horses..... "	....	....	....	....	....	75 00 to 150 00
Extra drivers ..... "	110 00 to 170 00	110 00 to 170 00	110 00 to 170 00	110 00 to 170 00	110 00 to 170 00	100 00 to 145 00
Good matches..... "	250 00 to 400 00	250 00 to 400 00	250 00 to 400 00	250 00 to 400 00	250 00 to 400 00	250 00 to 400 00
Mules:						
14 to 15 hands high "	55 00 to 95 00	40 00 to 80 00	35 00 to 75 00	35 00 to 80 00	35 00 to 100 00	55 00 to 85 00
15 to 16 hands high "	80 00 to 140 00	60 00 to 120 00	55 00 to 115 00	55 00 to 115 00	75 00 to 130 00	75 00 to 140 00
16 to 16½ hands high "	115 00 to 140 00	100 00 to 120 00	95 00 to 115 00	95 00 to 115 00	95 00 to 130 00	110 00 to 140 00
NEW ORLEANS.						
Cattle:						
Corn-fed beeves..cental	2 00 to 4 50	2 00 to 4 50	2 50 to 5 00	3 50 to 5 00	3 00 to 5 00	3 00 to 4 50
Choice Texas beeves. head...............	....	....	....	....	....	25 00 to 30 00
Texas, 1st quality.head	30 00 to 35 00	30 00 to 35 00	30 00 to 35 00	30 00 to 35 00	30 00 to 35 00	20 00 to 24 00
Texas, 2d quality.. "	15 00 to 25 00	15 00 to 25 00	15 00 to 25 00	15 00 to 25 00	15 00 to 25 00	15 00 to 18 00
Milch cows........ "	30 00 to 90 00	30 00 to 90 00	25 00 to 75 00	25 00 to 75 00	25 00 to 75 00	25 00 to 75 00
Calves............ "	6 00 to 8 00	6 00 to 9 00	6 00 to 9 00	6 00 to 9 00	6 00 to 9 00	6 00 to 9 00
Sheep.............. "	2 00 to 4 00	2 00 to 4 00	2 00 to 4 50	2 00 to 4 50	2 00 to 4 50	2 00 to 4 00
Swine..... .... "	3 00 to 4 00	2 50 to 3 50	3 50 to 4 50	3 00 to 3 50	3 00 to 4 50	3 00 to 4 50
Horses:						
Common.......... "	50 00 to 100 00	50 00 to 100 00	50 00 to 100 00	50 00 to 100 00	50 00 to 100 00	50 00 to 100 00
Plugs............. "	....	....	....	....	....	....
Good working .... "	100 00 to 175 00	100 00 to 175 00	100 00 to 175 00	100 00 to 175 00	100 00 to 175 00	100 00 to 175 00
Mules:						
First-class......... "	175 00 to 225 00	175 00 to 225 00	175 00 to 225 00	175 00 to 225 00	175 00 to 225 00	175 00 to 225 00
For sugar plantations, head...............	....	....	....	....	....	....
For city use.......head	175 00 to 225 00	175 00 to 225 00	175 00 to 225 00	175 00 to 225 00	175 00 to 225 00	175 00 to 225 00
For rice culture, small, head	100 00 to 150 00	100 00 to 150 00	100 00 to 150 00	100 00 to 150 00	100 00 to 150 00	100 00 to 150 00

The above table explains itself, and is given as furnishing an indication of the relative view of the live stock markets and prices in the United States, for general reference.

LIVE-STOCK MARKETS FOR 1879—Continued.

Products.	July.	August.	September.	October.	November.	December.
NEW YORK.						
Cattle:						
Extra beeves.....cental	$ 9 50 to $10 00	$10 50	$10 50 to $10 75	$ 9 75 to $10 00	$ 9 75 to $10 25	$10 00 to $10 50
Good to prime "	8 00 to 9 25	$ 7 75 to 10 00	7 75 to 10 25	8 75 to 9 50	7 50 to 9 50	7 75 to 9 75
Common to fair "	7 50	....	....	7 00 to 8 50	6 25 to 7 00	7 25 to 7 75
Poor to common "	....	....	....	....	....	....
Texas and Cherokee, cental..............	....	6 50 to 7 00	6 50 to 6 75	....	....	....
Milch cows........head	30 00 to 50 00	25 00 to 35 00	30 00 to 45 00	35 00 to 48 00	40 00 to 60 00	40 00 to 60 00
Veal calves......cental	2 50 to 5 50	2 37 to 6 25	2 25 to 5 50	4 00 to 6 25	2 25 to 7 25	2 00 to 7 50
Sheep............ "	3 00 to 5 62½	3 75 to 5 75	3 75 to 5 25	3 50 to 5 00	3 00 to 4 80	5 25 to 5 50
Swine............ "	....	4 00 to 4 25	3 60 to 3 80	4 00 to 4 30	3 90 to 4 30	3 50 to 4 31
CINCINNATI.						
Cattle:						
Fair to good shipping steers..........cental	3 75 to 4 35	3 75 to 4 50	4 00 to 4 50	3 85 to 4 40	3 80 to 4 60	3 90 to 4 50
Common to choice butchers' grades.....cental	1 75 to 4 25	1 50 to 4 00	1 50 to 4 00	1 50 to 3 75	1 50 to 3 60	1 40 to 3 60
Cows, heifers, etc. "	3 00 to 4 00	2 75 to 3 75	3 00 to 4 00	3 00 to 3 65	3 00 to 3 50	2 00 to 2 50
Sheep............ "	2 25 to 4 75	2 00 to 4 00	2 00 to 4 25	2 35 to 4 25	2 25 to 4 25	2 50 to 4 50
Swine............ "	3 00 to 4 00	2 75 to 3 70	2 60 to 3 70	2 80 to 3 85	3 00 to 4 00	3 50 to 4 75
CHICAGO.						
Cattle:						
Extra beeves.....cental	4 75 to 4 90	4 80 to 5 15	5 00 to 5 30	4 65	4 70 to 4 90	4 65 to 4 85
Choice beeves.... "	4 40 to 4 60	4 40 to 4 60	....	....	4 35 to 4 60	4 25 to 4 50
Good beeves..... "	4 10 to 4 40	4 00 to 4 10	....	....	3 80 to 4 20	3 75 to 4 15
Medium grades.. "	3 75 to 4 00	3 50 to 3 90	....	3 25 to 4 00	3 25 to 3 75	3 15 to 3 65
Inferior natives "	2 00 to 2 40	1 75 to 2 25	2 00 to 3 50	2 25 to 2 75	1 50 to 2 25	1 75 to 2 00
Texans........... "	2 75 to 3 50	2 25 to 2 80	2 25 to 2 65	2 40 to 2 60	2 40 to 3 10	....
Veal calves...... "	3 25 to 5 25	3 25 to 5 00	....	....	3 00 to 4 75	2 75 to 4 75
Sheep............ "	2 25 to 4 75	2 50 to 4 75	2 50 to 4 75	2 50 to 4 25	3 00 to 3 75	3 00 to 4 25
Swine............ "	3 00 to 3 85	2 25 to 3 75	3 00 to 3 75	3 15 to 3 80	3 40 to 3 95	4 00 to 4 70
SAINT LOUIS.						
Cattle:						
Choice natives...cental	4 70 to 5 00	4 70 to 4 80	4 70 to 4 85	4 70 to 4 80	4 70 to 4 80	4 60 to 4 70
Fair to prime natives, cental..............	4 15 to 4 65	4 15 to 4 65	3 75 to 4 60	3 75 to 4 60	3 75 to 4 60	3 50 to 4 40
Fair to good butchers' steers..........cental	3 75 to 4 25	3 75 to 4 40	3 00 to 3 60	3 00 to 3 60	3 00 to 3 60	3 00 to 3 60
Common to good stock steers.........cental	2 25 to 3 40	3 00 to 3 75	2 00 to 3 25	2 00 to 2 75	2 00 to 2 75	2 00 to 2 75
Texans and Cherokees, cental..............	3 00 to 4 00	3 00 to 4 00	2 25 to 3 75	....	2 27 to 3 75	2 25 to 3 75
Sheep.............cental	3 75 to 3 12½	2 50 to 2 95	2 15 to 3 25	2 00 to 4 25	2 25 to 4 15	2 25 to 4 00
Swine............ "	3 40 to 4 00	3 45 to 4 00	2 80 to 3 55	2 50 to 3 75	2 90 to 3 80	3 20 to 4 00
Horses:						
Plugs.............head	25 00 to 40 00	25 00 to 40 00	25 00 to 40 00	25 00 to 40 00	20 00	25 00 to 40 00
Southern horses... "	40 00 to 70 00	40 00 to 70 00	40 00 to 70 00	30 00 to 70 00	40 00 to 70 00	30 00 to 70 00
Streeters .... "	80 00 to 100 00	80 00 to 100 00	70 00 to 100 00	80 00 to 100 00	80 00 to 90 00	80 00 to 100 00
Heavy draft. .... "	90 00 to 140 00	90 00 to 140 00	90 00 to 135 00	90 00 to 125 00	85 00 to 130 00	90 00 to 125 00
Saddle horses..... "	75 00 to 150 00	75 00 to 150 00	75 00 to 150 00	75 00 to 150 00	70 00 to 125 00	75 00 to 150 00
Extra drivers ..... "	125 00 to 175 00	125 00 to 175 00	125 00 to 200 00	125 00 to 200 00	85 00 to 135 00	85 00 to 200 00
Good matches..... "	250 00 to 400 00	225 00 to 400 00	....	....	....	....
Mules:						
14 to 15 hands high "	50 00 to 90 00	55 00 to 95 00	50 00 to 90 00	50 00 to 90 00	50 00 to 85 00	50 00 to 70 00
15 to 16 hands high "	85 00 to 140 00	85 00 to 140 00	85 00 to 135 00	90 00 to 140 00	85 00 to 140 00	75 00 to 140 00
16 to 16½ hands high "	110 00 to 140 00	110 00 to 140 00	110 00 to 165 00	110 00 to 175 00	110 00 to 175 00	110 00 to 175 00
NEW ORLEANS.						
Cattle:						
Corn-fed beeves..cental	....	....	....	....	2 50 to 4 00	2 50 to 4 00
Choice Texas beeves, head..............	30 00 to 35 00	30 00 to 35 00	30 00 to 35 00	....	....	....
Texas, 1st quality.head	24 00 to 28 00	24 00 to 28 00	24 00 to 28 00	....	....	....
Texas, 2d quality.. "	15 00 to 20 00	15 00 to 20 00	15 00 to 20 00	....	....	....
Milch cows........ "	25 00 to 75 00	25 00 to 75 00	25 00 to 75 00	35 00 to 80 00	35 00 to 80 00	35 00 to 80 00
Calves............ "	5 00 to 8 00	5 00 to 8 00	5 00 to 8 00	5 00 to 8 00	7 00 to 9 00	7 00 to 9 00
Sheep............. "	2 00 to 4 00	2 00 to 4 00	2 00 to 4 00	2 00 to 4 00	2 00 to 4 00	2 00 to 4 00
Swine............. "	3 00 to 4 50	3 00 to 4 50	3 00 to 4 50	3 00 to 4 50	3 50 to 4 50	3 00 to 4 50
Horses:						
Common.......... "	50 00 to 100 00	50 00 to 90 00	50 00 to 90 00	50 00 to 90 00	....	....
Plugs............ "	....	....	....	....	50 00 to 90 00	45 00 to 75 00
Good working .... "	100 00 to 175 00	90 00 to 110 00	90 00 to 120 00	90 00 to 100 00	90 00 to 120 00	90 00 to 100 00
Mules:						
First-class........ "	175 00 to 225 00	....	175 00 to 225 00	140 00 to 210 00	....	....
For sugar plantations, head..............	....	125 00 to 190 00	....	....	160 00 to 170 00	150 00 to 210 00
For city use.......head	175 00 to 225 00	150 00 to 200 00	140 00 to 210 00	....	160 00 to 200 00	150 00 to 210 00
For rice culture, small, head..............	100 00 to 150 00	....	100 00 to 110 00	100 00 to 120 00	105 00 to 135 00	100 00 to 120 00

The above table explains itself, and is given as furnishing an indication of the relative view of the live stock markets and prices in the United States, for general reference.

The total number of the various live stock of the United States in 1879, the average price and the total valuation is as follows:

	Number.	Average price.	Value.
Horses	10,938 700	$52 41	$573,254,808
Mules..................	1 713,100	56 6	96,033,971
Milch cows.	11,826,400	21 73	256,953,928
Oxen and other cattle.	21,40 ,100	15 39	3 9 543,327
Sheep....	38 123,800	2 07	79,023,984
Hogs......	34,766,100	3 18	110,613,044

Or again, the total number of live stock in the United States may be stated, in round numbers, at about 100,000,000, worth $1,500,000,000, an immense aggregate amount considering the low average value, the great bulk being produced at far distant points from the place of consumption. For other matter in relation to stock, see articles Cattle, Horses, Sheep, Swine, Poultry, etc. For birds see articles under the several names of the various kinds noticed. (See Supplement.)

LIXIVIATION. The process of washing out the soluble from the insoluble portions of mineral substances, as in making lye; hence, lixivium means a lye or alkaline solution.

LIZARDS. *Lacertidæ, Lacertians.* Harmless reptiles, but of utility from the insects which they devour.

LOAD. A vague measure; it is better understood when divided into one, two, or three horse loads. A single horse load is generally estimated at thirty bushels, one cubic yard, or one ton by weight.

LOAM. A vague term, meaning soil, and containing a large proportion of vegetable matter and clay. In Prof. Johnston's lectures, a loam is represented as a soil containing thirty to sixty per cent. of sand, the rest being clay, limestone, or vegetable matter; a clay loam contains but twenty to thirty per cent. sand, and a sandy loam upward of sixty per cent. sand. This word is often improperly written loom, and applied to a friable rich soil, containing much decaying vegetable matter.

LOBBY. An anteroom or hall.

LOBATE, LOBED. Divided into large curved segments more or less circular.

LOBELIA. A genus of plants containing many very poisonous species, as the Indian tobacco (*L. inflata*), which is of use in asthmas, and as an emetic. They are pretty herbaceous plants, with perennial roots, and often cultivated for their beauty.

LOBLOLLY BAY, HOLLY BAY. *Gordonia lasianthus.* A large southern evergreen found growing in swamps, producing large white flowers. The wood is rosy, but light and brittle; the bark is extensively used in tanning in the southeastern States. It very much resembles the magnolia.

LOCKED JAW. *Tetanus, trismus.* A consequence of injuries about the feet, or of worms, severe nervous diseases; the muscles become rigid, and finally locked jaw supervenes. When it arises from a wound or laceration, the case is usually hopeless; when disease (*tetanus*), large doses of opium are found to do most good, with the removal of all causes of irritation. The strength must be sustained by injections of broths and soups.

LOCKING WHEELS. Hindering the rolling of one or more wheels in descending steep hills. It is done by fastening a chain from the body of the wagon to the spokes of the wheel, or by levers of a drag.

LOCOMOTION. Change of place.

LOCUAR. A cell or division in a fruit; thus, fruits are unilocular, bilocular, etc.

LOCULICIDA. A term designating the bursting (dehiscence) of a seed vessel along the back suture.

LOCUST. *Caloptenus. Orthoptera.* The great devastation produced by grasshoppers, as they are generally called, but which are really locusts, deserve more than a passing notice of these destructive insects. In every age of the world they have scourged continental countries. In the United States their depredations have been confined to the trans-Mississippi regions, and hence, until the settlement of that country they have attracted but little notice. The late Dr. Walsh, and his since famous pupil and co-laborer, Dr. Riley, and Dr. Thomas, the present State Entomologist of Illinois, and Dr. Packard, have spent much labor in investigating the history and habits of the American species, and the three latter gentlemen are now just finishing up this work, as members of the Entomological Commission, under a special act of the Congress of the United States. In 1866, Dr. Walsh published the results of his previous investigations of the insect which has since committed such wide-spread havoc, and to which he gave the name of *Caloptenus spretus*, and the English name of hateful grasshopper. In presenting this subject Dr. Walsh remarked that the eggs, which in the autumn of that year were deposited in the trans-Mississippi country, in countless myriads, would not hatch out that autumn, but would lie in the ground until the succeeding spring, and then hatch out, if the conditions for life were proper, and do vast injury. At the same time he distinctly foretold that the locusts developed from these eggs would have their generative functions so impaired by the difference in food, climate, density of air, temperature, moisture, etc., which they met in the lowland country, that they would become incapable of further propagating their species, and that they would then and there die out; also that the species would never cross the Mississippi river. The first of these predictions were fully verified, and the second has so far been as fully correct. The United States Entomological Commission has now been engaged some three years in their investigations of the locust, and have added much valuable information and suggestions to what was known before. From their reports published by the Government, we shall freely extract the principal points of general interest. The account of the visitations up to 1877 will be found in the table on the next page. The classification and nomenclature or characters of the species of our locusts are given as follows: When the popular name of a group of insects or other animals, that is generally accepted, corresponds somewhat closely in its application to the scientific division, it is not difficult to convey to the general reader a correct idea of the position and characters of a given species by reference to and comparison with well-known species of that group. Unfortunately, in the present instance, not only is the opportunity for refer-

TABULAR VIEW OF LOCUST YEARS.

Texas.	Arkansas.	Indian Ter.	Missouri.	Kansas.	Nebraska.	Iowa.	Minnesota.	Dakota.	Montana.	Idaho.	Wyoming.	Colorado.	Utah.	New Mexico.	Nevada.	Washington T. and Oregon.	British North America.
1845 1847 1849 1854 1855 1856 1857 *1858 *1866 *1867 1868 ?1872 *1873 *1874 1875 *1876 *1877	1876 1877	1874 1875 1878 1877	?1820 ?1821 *1866 *1867 1868 1869 *1874 *1875 *1876 1877	1854 1856 1857 1860 *1866 *1867 1868 1869 1872 *1874 *1875 *1876 1877	1857 1858 1861 *1864 *1866 *1867 1868 1873 *1874 *1875 *1878 1877	1833 1856 1857 1864 1865 1866 *1867 1868 1870 1871 1873 *1874 1875 *1876 1877	1830 1842 ?1849 ?1855 1858 1857 1863 1864 1865 1866 1867 1889 1870 1871 1872 1873 *1874 1875 *1878 1877	1853 1863 1864 1865 1868 1867 1868 1869 1870 1871 1872 1873 *1874 *1875 *1878 1877	1861 *1862 1863 1864 *1865 *1866 *1867 1868 *1869 1870 1871 1872 1873 *1874 *1875 *1878 1877	1852 1869 1870 1876 *1877	1842 1846 1847 ?1855 or 1856 1857 1870 *1873 *1874 *1875 *1878 1877	*1864 *1865 1866 *1867 1869 1872 1873 *1874 *1875 *1876 1877	*1851 1852 1853 1854 *1855 *1856 1857 1858 1859 1860 1861 1862 1863 *1864 1865 *1866 *1867 *1868 1869 1870 *1871 1872 1875 *1876 1877	1864 1865 1876	1870 1871 1877	1875 1878 or 1877 or	1800 1808 1818 1819 1857 1858 *1864 1865 *1872 1873 *1874 *1876 *1876 1877

(*) Bad locust years. (?) Doubt of the visitation.

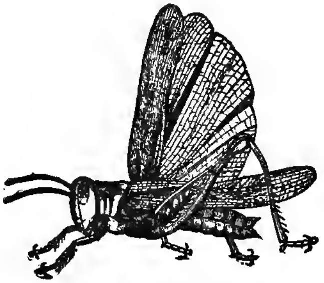
ence to well-known species wanting, but the popular names applied to species and groups are so confused and erroneous that their use is calculated to convey incorrect ideas to unscientific readers. Even the name locust as formerly, and yet very generally, applied in this country is incorrectly used, referring to an insect not even belonging to the same order as the locusts of oriental countries. The seventeen-year locust of North America is, in fact, not a locust in the true sense, but a species of *Cicada,* or harvest-fly, belonging to the order *Hemiptera,* which contains only insects with a mouth prolonged into a horny, jointed tube formed for sucking the juices of the plants or animals on which they feed. On the contrary, the locusts of the Old World, to which the term was originally and correctly applied, are species of migratory grasshoppers belonging to the order *Orthoptera,* and are furnished with strong biting jaws or mandibles. There are other very material differences between the two, but these will suffice to show that they are quite distinct. The very common name grasshopper has likewise been unfortunate in its use and application not only in a popular sense, but even by scientists, referring at one time to the true locusts or to the various species of the family to which they belong, and at another to species of a different family, which includes katydids. In fact, the term as generally used applies to most of the species of two different families of *Orthoptera.* In order, therefore to convey a correct idea of the destructive species now under consideration we are necessarily compelled to fall back upon the scientific arrangement and characters of the family, subdivisions, and species. Commencing with the order, we will give briefly the characters of the various divisions and subdivisions leading to the genus *Caloptenus,* to which the Rocky mountain locust belongs, omitting those divisions and groups not represented in the United States, and referring only to those characters which are most easily recognized, and which apply specially to our acridian fauna. The order *Orthoptera* is distinguished from the other orders of the insect class chiefly by the following characters: Mouth furnished with mandibles or strong biting jaws; wings four (occasionally wanting,) upper pair coriaceous or parchment-like and flexible; under pair thin and membranous, folding lengthwise only in plaits like a fan; transformations incomplete, being active in all stages after hatching from the egg. Although not as extensive as some other orders, it contains a large number of species which differ very materially in appearance and characters, and are generally known in this country by the common names earwigs, cockroaches, devil's-horses, walking-sticks, grasshoppers, and crickets. Each of these names, except the next to the last, represents a distinct family of the order, as given below:

Earwigs	Family 1. *Forficuladæ.*
Cockroaches	Family 2. *Blattidæ.*
Devil's-horses	Family 3. *Mantidæ.*
Walking-sticks	Family 4. *Phasmidæ.*
Grasshoppers	Family 5. *Acrididæ,*
	Family 6. *Locustidæ.*
Crickets	Family 7. *Gryllidæ.*

As will be seen from this list, there is no confusion between the scientific and common names until we reach grasshoppers, among which our insect belongs. Other names, it is true, are sometimes applied to insects of the previous families, but with the exception of earwig they correspond in their application with the family limits as here given. As before stated, the term grasshopper is applied to insects of two families—*Acrididæ* and *Locustidæ;* but notwithstanding this difficulty in using the popular name the insects which compose the family are easily distinguished from each other by prominent characters. *Locustidæ* includes those species usually found on the grass, bushes, and trees, which have very long thread-like antennæ, generally longer than the body of the insect; the tarsi or feet are four jointed; the female is furnished at the tip of the abdomen with an exserted ovipositor, usually more or less curved and sword-shaped; and the upper wings of the male are furnished, at the base, with a peculiar arrangement of the nerves, with which, by rubbing them together, they produce sharp, shrill notes. To this family belong true grasshoppers, katydids, and similar insects; and there are other species which strongly resemble and are usually called crickets that belong to this family. *Acrididæ,* includes those species which usually reside on the ground, and are distinguished from those of the other families of saltatorial orthoptera by the following characters: The antennæ are comparatively short, never exceeding the body in length, and in North American species composed of from twelve to twenty-five joints; the tarsi are apparently three-jointed; the females are furnished at the tip of the abdomen with four short corneous pieces, two of which curve upward and two downward; the male is without the shrilling organ at the base of the wings found in the *Locustidæ.* This family contains the true locust, such as those of oriental countries and the Rocky Mountain Locust; also such so-called grasshoppers as the common red-legged species of the States and those found hopping on the ground in open waste fields, along roadsides, etc. Therefore, in speaking hereafter of these species, we shall use the term locust. As the family contains a very large number of species varying considerably in form and character, entomologists have endeavored to divide it into sections or subfamilies, by bringing together those minor groups having certain characters in common. The various results of these attempts can not be introduced here, as this would not only require too much space, but also the introduction of matter of purely scientific interest, and of no practical use in this brief review of the classification. These subdivisions vary in number according to the characters selected by the different authors, some making as many as eleven subfamilies, others only two or three. Yet, as a general rule, the difference is not so much in the grouping as in the value attached to the groups, the sub-families of one author being considered as subordinate divisions by other authors. Without undertaking at this time to decide upon the respective merits of these several arrangements, we have selected for present purposes that which makes but three subfamilies, as it appears to be the simplest and most easily understood by general readers. In our descriptions of these subdivisions we shall confine ourselves to those represented in the orthopteral fauna of that portion of North America north of Mexico, and so far as possible select such characters only as are necessary to distinguish these divisions from each other. The first subfamily, *Proscopinæ*, contains only exotic species, and may therefore be omitted from further consideration. The second subfamily, *Acridinæ*, is distinguished by having the pronotum in the form of a shield, which covers the prothorax and extends backward at farthest only a short distance upon the base of the abdomen, never reaching more than half way to the tip, and seldom half this distance; the prosternum or front breast is drawn up, that is, it is not in the same plane as the rest of the sternum or breast; it is spined, tubercled, or smooth, but never advanced upon the mouth in the form of a muffler; elytra or upper wings, when present, always as long as the wings; tarsi with pads between the claws. The third subfamily, *Tettiginæ*, is characterized by having the pronotum, in the form of a shield, extending backward nearly or quite to the tip of the abdomen, and sometimes even beyond it; the prosternum in the same plane as the rest of the sternum, and advanced upon the mouth in the form of a muffler; elytra when present usually shorter than the wings, and placed at the sides of the body; tarsi without pads between the claws. The two latter families are represented in the United States, but the great body of our locusts belong to the *Acridinæ*, the species of *Tettiginæ* being comparatively few, quite small, and seldom noticed by unscientific observers. As the *Caloptenus spretus* and all other migratory locusts belong to *Acridinæ*, we shall limit our further consideration to this subfamily. It contains several subordinate groups, but the characters by which these are distinguished from each other are not so apparent and uniform as are those separating the various sub-families. Although at least one species of *Oedipodini* is migratory in the Old World, and a species in North America (*Camnula pellucida*, Scudd.) belonging to the same group was formerly supposed to be the migratory locust of California, yet at present our observations are confined to *Acridini*, which contains the destructive locust of the West. This limits us to those species found in the United States which have the head more or less subglobular or ovoid, and the front breast armed with a spine. The latter character is easily recognized by any one, as the spine may be seen by examining the under side of the neck; it usually stands out like a little blunt thorn, very distinct. If this is wanting, the observer may know without further observation that his specimen does not belong to the migratory species of our country. If it has the spine, and the head is not conical or pyramidal, then he must refer to the characters hereafter given of the genera and species. We have now reached the genera, which can not be fully discussed at present, as this would require, if properly done, a revision of the *Calopteni* and *Pezotettigi*, and an examination of all our native species. We will, therefore, simply mention the more important genera of the group represented in the United States, calling attention to a few of the more prominent characters by which *Caloptenus* is separated from those genera most closely allied to it. We will also make use of localities, habits, etc., wherever they will assist the general reader in any way in determining whether or not a given specimen belongs to *Caloptenus*. The following genera of *Acridii* which are mentioned by North American authors may be omitted from further consideration for the reasons given below: *Tropidacris*, *Dictyophorus*, *Rhomalea*, *Ommatolampis*, *Platyphyma*, *Dactylotum*, and *Chromacris*. The first contains only gigantic species, and if represented at all in the United States, it is only by a single species occasionally found along the southwestern border of Texas. *Rhomalea* may be considered as a synonym of *Dictyaphorus*, which is represented by but two subtropical species, which are large, with brightly colored under-wings, chiefly red; while those of our Calopteni are transparent. *Ommatolampis* has been superseded by Mr. Scudder's genus *Hesperotettix*. *Platyphyma* and *Chromacris* have probably been introduced by mistake. *Dactylotum* has been introduced into our nomenclature for the reception of a very short-winged and brightly-colored species—*Pezotettix picta* Thos. This leaves only the following genera as necessary to be considered: *Acridium*, *Caloptenus*, *Hesperotettix*, and *Pezotettix*. As *Hesperotettix* contains, so far as we are aware, but three species, easily distinguished from *Caloptenus spretus* by the following characters and facts it may be also excluded: One is short-winged, green, and found only in the Eastern Middle States; another somewhat common in the West is green, with reddish bands around the femora; the other has so far been found only in Arizona; it is yellow, thickly dotted over with black, and the antennæ annulated with alternate colors. There is a difference of opinion in reference to the characters of the genera *Caloptenus* and *Pezotettix*; Professor Stal, of Sweden, maintaining that if properly limited *Caloptenus* does not embrace any of our species. He places *C. femur-rubrum*, and consequently the closely allied species, in *Pezotettix*. Without attempting to discuss the question so far as it relates to the proper characters, we have concluded, for reasons which will be mentioned further on, to retain the name *Caloptenus* and to use the genus in the sense understood by American and most European authors. Although the chief distinction between this genus and *Pezotettix*, as adopted in this country, the difference in the length of the wings, can not be considered satisfactory, yet, as it will answer present purposes, we will avail ourselves of it in order to eliminate the group from consideration. *Acridium*, so far as represented in the United States, may be characterized as follows,: Vertex but slightly inclined, angularly expanded in front of the eyes; antennal grooves profound and extending downward to the clypeus; eyes elongate-elliptical. Pronotum somewhat compressed on the sides, depth usually considerably more than the width, moderately but distinctly expanding behind the last sulcus (very slightly in *rubiginosum*); lateral carinæ obsolete on the anterior lobes, the sides rounding up somewhat as the sides of an arch to the median carina; the dorsum of the posterior lobe more flattened, with the lateral carinæ subdistinct; the lower margin of the lateral lobes straight, the posterior lateral angle slightly obtuse, varying from about 100° to 110°; posterior margin obtuse-angled and rounded at the tip. Elytra and wings, with one exception, considerably longer than the abdomen, and in the exception pass it slightly. Abdomen elongate, rather slender; that of the male not enlarged at the tip; the last segment of the male subconical and distinctly notched at the tip, usually with a square notch; cerci of the male flat, usually broad, oblong, and straight. Prosternal spine, robust, subcylindrical, blunt, and approximating the margin mesosternum. The spines of the posterior tibiæ always have at least the basal portion pale, either yellowish or white, even when the tibiæ are black. Posterior femora long, reaching to the tip of the abdomen, moderately robust, the outer face flat. The species, with one exception, are large, the females exceeding two inches in length, the exception, *rubiginosum*, is rare in the West, and so far has not been found west of the Mississippi. We have omitted *A. frontalis* (Thos.), as it does not properly belong to this genus, having been placed here by the author provisionally. As it is green, there is no danger of its being confounded with *C. spretus*. To this genus belongs *A. Americanum*, a large reddish-brown species, marked on the outer wings with cellular quadrate fuscous spots, which often does considerable injury to crops in the sections south of the latitude of St. Louis, which is nearly its northern limit. In 1875 and 1876, and even in 1877, it was seen migrating in considerable numbers, causing much alarm, as those who saw them supposed they were veritable Rocky Mountain locusts. Such flights were observed in southeast Indiana, southwest Ohio, Southern Illinois, and Georgia. These flights are very limited in extent, reaching at farthest but a mile or two. Their large size, coloring, generic characters, and southern habitats will readily distinguish them from the *C. spretus*. We may remark here that one of the most destructive migatory species of southwestern Asia and northern Africa (*Acridium peregrinum*) is not only congeneric with this species, but so closely resembles it that ordinary observation would scarcely detect the differences between the two. As before stated, the characters by which the genus *Pezotettix* is distinguished are not satisfactory, and undoubtedly require revision, but in this country the abbreviation or want of wings has generally been adopted as a leading character, which, whether well chosen or not, is sufficient to distinguish its species from *C spretus*, which answers our present purpose. This limits us to the genus *Caloptenus*, and the species belonging to it which are found north of Mexico. The character of *Caloptenus* and *Pezotettix*, as given by H. Fischer, (Orthoptera Europea, 1853) were evidently intended to embrace only European species, and although we infer from his remarks that he would include our species of Calopteni in the former genus, yet the characters render it very doubtful where they would fall. Therefore, while we admit that the group stood sadly in need of revision at the time Stal entered upon the work, yet we do not think the facts warrant him in dropping the generic name *Caloptenus*, or in removing *femur-rubrum* therefrom, hence we can not follow him in this change. This is, perhaps, not a proper place to discuss a question of this kind, but we have considered it necessary to say this much in explanation of our reasons for differing with so distinguished an entomologist, in his special field, as Dr. Stal. Under the circumstances it is perhaps best that we should define the genus as we understand it, or at least give the characters which the North American species have in common, which we include in *Caloptenus*. In this connection the editor would say, that for the reasons given above, and also as a means of perfect identification not only by the scientific but the general observer as well, we append the full description, which is as follows:

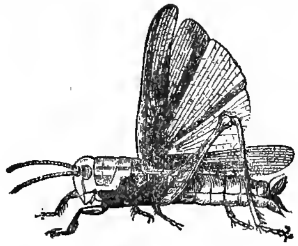
Calŏptenus, general character, head subglobular, front vertical, or nearly so. Eyes ovoid, sometimes almost suborbicular, but usually the length is to the breadth as three to two, and the front side is more or less straightened; usually the upper canthus is more or less angular, but sometimes it is rounded so as to obliterate the angle; generally rounder and more prominent in the male than in the female; separated above by a little less than their width. Vertex narrow between the eyes, the width at this point being a little less than the width of the eye; usually though not always sulcate, the sulcus or groove shallow; expanding slightly, abruptly, and angularly immediately in front of the eyes; deflexed (15° to 40°), and generally rounded in front. Frontal costa usually quite prominent, about as broad as the vertex between the eyes; sides parallel; flat, or shallowly sulcate, reaching to or nearly to the clypeus. Pronotum subquadrate, that is to say, a cross section (in the middle) will present a quadrate figure or parallelogram with the upper corners slightly rounded; the sides are nearly perpendicular; the disk or dorsal surface is very nearly flat, with a little thread-like, median carina, usually distinct on the posterior lobe, but sometimes obliterated on the middle and anterior lobes; the lateral carinæ are obtuse, but distinctly marked as the angle where the disk and sides meet; on the posterior lobe they sometimes appear as true carinæ, though not prominent or sharp; the lower margin of the sides is nearly straight, sometimes projecting a little in the middle, where the triangular piece connects; the posterior lateral margin varies somewhat; in some species it forms a distinct entering angle at the shoulder or lateral carina, in others it continues to the tip in an almost straight line; the three transverse incisions are distinct and situated close together, the posterior one being a little behind the middle and always cutting the middle carina; all three sever the lateral carinæ, but the anterior one ends at the upper margin of the sides with a slight and short curve forward; the posterior and middle ones extend down the sides well toward the lower margin, and most generally about midway down the posterior sends out at right angles a branch sulcus which often crosses the intermediate space to the middle one; there is also a fourth sulcus extending down the sides close to the anterior margin; the posterior sulcus and usually the middle one make a short curve forward immediately at the median carina; the posterior margin is obtuse-angled, rounded at the tip; the posterior lobe is usually finely punctured, while the middle and anterior lobes have a velvety or felty appearance. The elytra and wings extend to or beyond the tip of the abdomen; the former are narrow (except in *C. bivittatus*); the latter transparent in all our species; sometimes a very light greenish-yellow or a bluish tinge is observed, the nerves usually more or less dark. The abdomen is usually subcylindrical, presenting no distinct keel above: that of the male enlarged at the tip and curved upward; the cerci are usually flat, rounded at the tip, and curved up but some are straight and others tapering. The last abdominal segment, which curves upward like the prow of a boat, is sometimes truncate above, sometimes with a slight angular notch. Posterior femora robust, much enlarged near the base, the external face more or less convex, in the female never longer and generally shorter than the abdomen; in the male the reverse is the rule. Pads between the claws large, reaching a maximum size in some of the species. Most of our species have the upper portion of the inner face of the posterior thighs marked with three oblique dark bands (the one at the base often indistinct). There is generally a dark stripe on the side running back from the eye to the last transverse sulcus of the pronotum, it is often interrupted, broken, or partially obliterated, but is seldom wholly wanting in those species any way closely allied to *C. spretus* or *C. femur-rubrum*. The antennæ are filiform and slender, reaching their maximum length in the male of *C. differentialis*, where they sometimes attain the middle of the body. The prosternal spine is usually stout and conical, quadrangular at the base, and generally slightly transverse; in one or two species it approximates the mesosternum, but this is not usual. Our species vary in length from six-tenths to two and a half inches.

The genus as thus characterized is represented in the territory embraced in our observations by a number of species, several of which are so closely allied to *C. spretus* that it is difficult for any but an experienced entomologist to determine to which a specimen belongs. We think it more than likely that future investigations will show that several of the species which have been described as distinct, are but varieties of other closely allied species. *C. bilituratus*, Washington Territory, has been observed at but one or two points. There are but three species, *femur-rubrum*, *spretus*, and *atlanis*, which require special mention in this connection, as they are the only ones generally distributed which are so closely allied to each other as to render it difficult to distinguish them. *Caloptenus spretus*, Thomas. As every fact relating to the history and habits of this species is either of economic or scientific interest, we give here a brief history of its nomenclature. About 1860, Mr. Thomas, then residing in Southern Illinois, sent some specimens of Orthoptera collected in that locality, to Dr. P. R. Uhler, of Baltimore, Md., for determination; among those returned was one marked *Acridium spretis*, with a note stating that it was new. In a paper written by Mr. Thomas on Insects injurious to vegetation in Illinois, in 1862, he describes a species of locust under the name *A. spretis* Uhler, as follows: general color a dark, brownish purple, with dusky points and lighter rays. Head brown, with dusky points; antennæ reddish yellow. Thorax an ashy brown, with a velvety luster on the anterior half, the latter half punctured; the lower edges, at the sides, paler —sometimes pale red, at others almost white. Elytra extending about half over the abdomen (or not exceeding two thirds), marked along their internal margins with a light, reddish-brown ray; external margin dusky; a few dusky dots along the internal margins. Wings not quite as long as the elytra; transparent, pale yellowish on the disk, tinged with red at the base (in recent specimens). Posterior thighs crossed by two black bands, and black at the knees; intermediate spaces pale yellow—often almost white. Length of female, one inch and three-eighths; of the male, slightly over an inch. This species is quite common here, along the road-side and among low weeds and grass. In Mr. Scudder's Catalogue of the Orthoptera of North America, published in 1868, it is mentioned under the name *Acridium spretum* Uhler. No description of the species having been published previous to the appearance of the Synopsis of the Acrididæ of North America, Mr. Thomas describes it as follows: Very much like *C. femur-rubrum*, Burm., the principal difference being in the length of the elytra and wings, a notch at the tip of the last (♂) ventral segment. Posterior lobe of the pronotum slightly expanding; median somewhat distinct. Elytra and wings pass the abdomen about one third their length. The last (♂) ventral segment, which is turned up almost vertically, is somewhat tapering and is notched at the apex, which distinguishes it from the *femur-rubrum;* the notch is small, but is distinct. Prosternal spine, robust, subcylindrical, transverse. Migratory. Color, scarcely distinct from the *C. femur-rubrum.* The occiput and disk of the pronotum generally reddish-brown; the posterior lobe somewhat paler than the anterior and middle. Spots as in *femur-rubrum*, arranged in a line along the middle of the elytra; these are a little larger and more abundant toward the apex. The head and thorax are sometimes a very dark olive-brown, at others reddish-brown and even brownish-yellow, the color deepening with age. The wings are pellucid, nerves dusky toward the apex; when flying high and against the sun, their wings look like large snow-flakes. Dimensions: ♀ Length (to tip of abdomen) 1 to 1.2 inches; elytra as long as the body; posterior femora, 0.55 inch; posterior tibiæ, 0.5 inch. ♂ Length, 0.85 to 1 inch; elytra, 0.9 to 1.05 inch. (The sign ♂, signifies male; ♀, female.—Editor.) In relation to the chronological history, the commission say: The history of the American or Rocky Mountain locust is in nearly all respects parallel with that of the locust of the Old World. It breeds over a large continental area, and periodically, in seasons of extreme drought and other favoring meteorological conditions, migrates in immense hordes for several hundred miles beyond its usual habitat. Unlike the locust of the Eastern Hemisphere, our species naturally affects the cooler and more elevated portions of the temperate zone in the New World, though its southern limits extend at times into the hot and dry plains of the Great Basin. Fitful and periodical in its visits to the older, settled portions of the West, the history of the Rocky Mountain locust is difficult to trace beyond a period of about thirteen years. Previous to the year 1864 it had been rarely referred to by travelers in the West, and after examining the reports of the government expeditions and the works of Lewis and Clark, Pike, Irving, and others, we find little or no mention made of it. It is a question in our mind whether in some regions it may not have increased in numbers since the Far West has been partially settled, particularly in those regions where irrigation has been practiced, as in Utah and Colorado and in the western edge of the Mississippi Valley, as in Nebraska, Kansas, Iowa, and Minnesota; but this is entirely uncertain, and it is more reasonable to suppose that as the Western Territories become more thickly settled the numbers of locusts will become diminished. In treating of the history of locust invasions, we will first consider the subject in a very general way, and then state the facts more concisely, arranged according to separate States and Territories; and, thirdly, present a summary of the subject in a tabular view. The latter is calculated to send a chill to the agricultural heart when one sees how dense the figures are from 1864 until 1877, and to lead one to infer that the evil is waxing greater and greater as the years go on. This may be due, however, to the greater extent of the country settled and to the fact that the population is growing denser and denser. However that may be, we shall deal with facts and not with theories, and would remind the reader that in a number of the years there recorded large harvests resulted, the injury done by locusts being local and only confined to a portion of the season, while in 1877 the largest wheat harvest ever grown was safely harvested. Leaving out of account the locust visitations in the Atlantic and Pacific States, which were made by different species from the Rocky Mountain locust, the first authentic statement is to be found in Neill's History of Minnesota, wherein it is stated that in 1818 and 1819 vast hordes of grasshoppers appeared in Minnesota, eating everything in their course, in some cases the ground being covered three or four inches thick. In the same years they were destructive in the Red River country in Manitoba. In 1820, or the succeeding year, they ravaged the western counties of Missouri, and Riley suggests that the 1820 swarms may have also ravaged Kansas and the neighboring regions northward. In 1842, locusts appeared in Minnesota and Wyoming; in 1845, in Texas; in 1846 and 1847, in the limits of what is now Wyoming; and in 1849 in Texas, and possibly in Minnesota. In Utah they have appeared from 1851 until 1877, except only the years 1873 and 1874, and a glance at the table shows that this Territory is liable to suffer annually more or less, especially in the northern portion. Vast swarms of locusts were seen in Idaho in 1852, as well as in Utah, while Dakota was visited, or had native swarms, in 1853. The year 1854 was a year for locusts in Texas, Kansas, and Utah, and 1855, notable for locust ravages on the Pacific coast, was not a bad year east, Texas only having been invaded, although A. S. Taylor states that they abounded on the immense grassy prairies lying on the eastern slopes of the Rocky mountains, a statement supported by no facts, so far as we can learn. In the year 1856, however, locusts prevailed in Texas, Kansas, Iowa, Minnesota, possibly Wyoming and Utah, and in the succeeding year they committed extensive ravages in Manitoba, and the States mentioned as suffering in 1856, with the addition of Nebraska. The States of Texas and Nebraska received slight injury from the progeny of those that migrated thither the previous two years. In 1860, the region about Topeka, Kan., was visited by what must have been a limited and rather local swarm. The year 1861 witnessed the presence of locusts in Nebraska, Montana, and Utah, but the accounts are scanty. Montana and Utah sustained losses from locusts in 1862, but in 1863 they occurred not only in those territories, but also in Dakota and Minnesota. But the most decided increase in the numbers of locusts was felt in 1864, a year of general visitation in Utah, Montana, Dakota, Colorado, portions of New Mexico, and east of the plains in Nebraska, Iowa, Minnesota, as well as Manitoba, and there were resulting swarms, in most cases the progeny of those which came in 1864, in Iowa, Minnesota, Dakota, and Manitoba, while Montana, Colorado, and northern New Mexico had swarms of their own. A notable locust year was 1866, and, as Riley states, the injury committed was sufficiently great and wide-spread to attract national attention. The insects swarmed over the Northwest and did great damage in Kansas, Nebraska, and northeastern Texas, and invaded the western counties of Missouri very much as they did in 1874. They came, however, about a month later than in that year. They were often so thick that trains were seriously delayed on account of the immense numbers crushed on the track. Iowa, Minnesota, Colorado, and Utah also suffered. While in 1867 local damage was done in the spring by the young of the swarms of the previous year, late in the summer new swarms flew across the plains from the West and Northwest, and invaded the border States; in fact, the same States suffered as in 1866, as will be seen by a glance at the tabular view. In 1868 and 1869, local injuries ensued from the ravages of the unfledged locust early in the season, and reports from Montana, Idaho, Dakota, Colorado, and Utah show that there was some trouble in those territories. The year 1870 was a season of comparative immunity from locust invasions, though Iowa and Minnesota received some swarms, and the insects were observed in Dakota, Idaho, Wyoming, and Utah. Kansas received slight injury from these pests in 1872, as well as Minnesota, Dakota, Montana, Colorado, and Utah, but it was not marked. In 1873, the hosts gathered for a fresh onslaught upon the agricultural region bordering the great plains. The invasion of 1873, says Riley, was pretty general over a strip of country running from the northern parts of Colorado and southern parts of Wyoming, through Nebraska and Dakota, to the southwestern counties of Minnesota, and northwestern counties of Iowa, the injury being most felt in the last two more thickly settled States. The insects poured in upon this country during the summer and laid their eggs in all the more eastern portions reached. The cry of distress that went up from the afflicted people of Minnesota in the fall of that year is still fresh in mind, and the pioneers of Western Iowa, in addition to the locust devastations, suffered severe damage from a terrific tornado. By far the most disastrous locust year, however, was 1874, as the more thickly settled portions of the Mississippi Valley west of the ninety-fourth meridian were invaded by dense and most destructive swarms. The States of Colorado, Nebraska, and Kansas were overrun, while portions of Wyoming, Dakota, Minnesota, Iowa, Missouri, New Mexico, Indian Territory, and Texas were ravaged by swarms from the Northwest, as they were abundant that year in Montana and in British America. The loss to these States and territories was estimated at not much less than $50,000,000. Much of the loss this year resulted from the progeny of the invaders of 1873, which early in the season devoured the crops of the region where they hatched, and eventually spread to the southeast. Kansas suffered, perhaps, more heavily than any other State. This, like most other locust years, was one of long-continued drought, and in Missouri the evil was complicated by the ravages of the chinch-bug. The next year (1875) the young hatched in immense numbers over an area variously estimated at from 250 to 350 miles from north to south and from 200 to 270 miles from east to west, embracing portions of Nebraska, Kansas, and Missouri. The tract in which the injury done by the destructive enemy was worst was confined to the two western tiers of counties in Missouri, and the four tiers of counties in Kansas, bounded by the Missouri river on the east. The greatest damage extended over a strip twenty-five miles each side of the Missouri river, from Omaha to Kansas City, and then extended south to the southwestern limit of Missouri. About three-quarters of a million of people were, to a greater or less extent, made sufferers. The experience of different localities was not equal or uniform. Contiguous farms sometimes presented the contrast of abundance and utter want, according to the caprices of the invaders, or according as they hatched in localities favorable to the laying of the eggs. This fact gave rise to contradictory reports, each particular locality generalizing from its own experience. The fact is, however, that over the region described there was a very general devastation, involving the destruction of three-fourths of all field and garden crops. While the injury was greatest in the area defined above, the insects hatched in more or less injurious numbers from Texas to British America, the prevalence of the insects in Manitoba being such that in many parts little or no cultivation was attempted. (Riley.) Missouri had never before been visited by a calamity so appalling and so disastrous in its results as the locust ravages of 1875, and detailed returns of the damage done in that State showed a loss of over $15,000,000. (Riley.) In 1876 no trouble was experienced in the spring, there being in the border States little damage done by the young, except in portions of Minnesota and Colorado, and it was hoped that no further losses would ensue this year. But locusts bred in great quantities in Montana, and in British America, north of this territory, and in Wyoming, Dakota, and Colorado, this being a year of unusual drought in those territories, and in August and the autumn following, immense swarms swept over the plains, falling upon the larger part of Kansas and Nebraska, the western half of Iowa, and some of the western counties in Missouri, and reaching into the Indian Territory, Texas, and the northwest corner of Arkansas. Besides this, local swarms hatching in Minnesota early in the year flew south and southwest into Iowa and Nebraska, and they laid eggs in August. The spring of 1877 opened with dismal prospects all over the States east of the plains, as well as in Colorado. Happily it was a spring in which there was an unusual rain-fall in April, May, and June, the country along the Missouri being flooded in places. The weather was also exceptionally cool; and this condition of things extended over Colorado, northern Utah, Wyoming, central Montana, and British America. In consequence of this season of wet and cold, the young hatched grasshoppers died in immense numbers, and comparatively few lived to acquire wings. South of the parallel of 40° they flew, late in May and early in June, in a general northwest and northerly course; and from Minnesota and Iowa many took flight to Dakota and Montana, whence their progenitors came, and others remaining behind flew about irregularly in the States of Minnesota and Iowa. The six stages of growth of the Rocky Mountain locust, and their metamorphoses, are described as follows: The Rocky Mountain locust requires on an average about seven weeks, from the time of hatching, to attain full growth. Belonging to an Order in which the tranformations are incomplete, the young locust differs but little in general structure from its parent. The most striking differences are the want of wings, and the less flattened, narrower prothorax, which rises from the sides more in the shape of a roof. The abdomen is also more roof-shaped. The perfect winged form is gradually assumed through a series of five molts, at the first four of which the wing-pads become more and more apparent, and at the last of which, from the pupa to the perfect state, the thorax becomes flattened, full wings are acquired, and the insect ceases to grow, except as the female abdomen becomes gravid and heavy with eggs. Yet with each molt, aside from the colorational changes, certain minute and less striking structural changes invariably take place, by observing which we may always know the comparative age and the particular stage of growth of any individual. European authors differ as to whether there are three, four, or five molts in the European migratory species; but we have watched *spretus* from the egg to the imago, and thousands of mounted and alcoholic specimens of all ages show the stages enumerated. The transition from the second to the third, however, is sometimes not very marked, and it is not improbable that, as is the case with many other insects, the number of molts may vary according to the amount of nutrition and rapidity of development. The sexual characters are not well marked, and the sexes are consequently distinguished, with some difficulty in the first three stages. In the first pupal stage the differences become apparent, and in the true pupa the parts are sufficiently well formed to permit coition, which, as we have had evidence, exceptionally takes place thus prematurely. The depth of coloring varies greatly in the immature stages, and the pale mediodorsal line, so conspicuous on some of the larvæ, is entirely wanting in others. The ground-color after the first stage varies from pale-yellowish-gray, the common and typical color, to orange-brown, and even black, and from pale yellow to pure green. A marked green variety (var. *Viridis*, Riley) occurs, in which the normal pale yellowish-gray parts are bright green, the green being first distinctly noticeable in the third larval stage, and enduring to maturity. We have never seen this green variety among the fresh arrivals from the mountain regions, but it is conspicuous among its brown companions when hatching in the Temporary region, and constitutes ordinarily about one in a thousand, though sometimes a much larger proportion, of the progeny of invading swarms. Like all creatures which suffer exuviation or the shedding of skin, our locust quits feeding for a while, and remains quiet during the process. The first three or larval skins are almost invariably shed on or near the ground, the young insects congregating under grass in little hollows or depressions; or under any shelter that offers for the purpose. The cast-off exuviæ are often very abundant in such sheltered places, and are not infrequently mistaken for dead locusts. The last two or pupal molts, on the contrary, more often take place above ground, the insect at these stages of growth preferring to fasten to some elevated object. Immediately after each molt the whole body is soft and colorless, as it was immediately after hatching. In order to illustrate the interesting process of molting, we will trace an individual through the last molt—from the pupa to the winged insect—as it is the most difficult, and, on account of the larger size of the animal, most easily watched. The other molts are very similar in mode of execution. When about to acquire wings the pupa crawls up some post, weed, grass stalk, or other object, and clutches such object securely with the hind feet, which are drawn up under the body. In doing so the favorite position is with the head downward, though this is by no means essential. Remaining motionless in this position for several hours, with antennæ drawn down over the face, and the whole aspect betokening helplessness, the thorax, especially between the wing-pads, is noticed to swell. Presently the skin along this swollen portion splits right along the middle of the head and thorax, starting by a transverse, curved suture between the eyes, and ending at the base of the abdomen. As soon as the skin is split, the soft and white fore body and head swell and gradually extrude more and more by a series of muscular contortions; the new head slowly emerges from the old skin, which, with its empty eyes, is worked back beneath, and the new feelers and legs are being drawn from their casings and the future wings from their sheaths. At the end of six or seven minutes our locust—no longer pupa and not yet imago—the four front pupa-legs being generally detached, and the insect hanging by the hooks of the hind feet, which were anchored while yet it had that command over them which it has now lost. The receding skin is transparent and loosened, especially from the extremities. In six or seven minutes more of arduous labor—of swelling and contracting—with an occasional brief respite, the antennæ and the four front legs are freed, and the fulled and crimped wings extricated. The soft front legs rapidly stiffen, and, holding to its support as well as may be with these, the nascent locust employs whatever muscular force it is capable of to draw out the end of the abdomen and its long hind legs. This in a few more minutes it finally does, and with gait as unsteady as that of a new-dropped colt, it turns round and clambers up the side of the shrunken, cast-off skin, and there rests while the wings expand and every part of the body hardens and gains strength—the crooked limbs straightening, and the wings unfolding and expanding like the petals of some pale flower. The front wings are at first rolled longitudinally to a point, and as they expand and unroll, the hind wings, which are tucked and gathered along the veins, at first curl over them. In ten or fifteen minutes from the time of extrication these wings are fully expanded and hang down like dampened rags. From this point on the broad hind wings begin to fold up like fans beneath the narrower front ones, and in another ten minutes they have assumed the normal attitude of rest. Meanwhile the pale colors which always belong to the insect while molting have been gradually giving way to the natural tints, and at this stage our new-fledged locust presents an aspect fresh and bright. If now we examine the cast-off skin, we shall find every part entire with the exception of the rupture which originally took place on the back; and it would puzzle one who had not witnessed the operation to divine how the now stiff hind shanks of the mature insect had been extricated from the bent skeleton left behind. They were in fact drawn over the bent knee-joint, so that during the process they were doubled throughout their length. They were as supple at the time as an oil-soaked string, and for some time after extrication they show the effects of this severe bending by their curved appearance. The molting, from the bursting of the pupa-skin to the full adjustment of the wings and straightening of the legs of the perfect insect, occupies less than three-quarters of an hour, and sometimes but half an hour. It takes place most frequently during the warmer part of the morning, and within an hour after the wings are once in position the parts have become sufficiently dry, and stiffened to enable the insect to move about with ease; and in another hour, with appetite sharpened by long fast, it joins its voracious comrades and tries its new jaws. The molting period, especially the last, is a very critical one, and during the helplessness that belongs to it the unfortunate locust falls a prey to many enemies which otherwise would not molest it, and not infrequently to the voracity of the more active individuals of its own species. The differences in the immature stages between the Rocky Mountain, the Lesser, and the Red-legged Locusts are thus stated. *Spretus*, (the Rocky Mountain Locust) though palest when mature, has the most black in the immature stages, and its black face is quite characteristic. One who has great familiarity with these three species in life can distinguish them at any stage (they all three go through the same number of molts), and can even distinguish between the exuviæ, those of *spretus* being darkest, those of *atlanis* most gray and uniformly speckled, and those of *femur-rubrum* palest, with the black streaks more strongly contrasting The continuation of the report is as follows: The eggs may be laid in almost any kind of soil, but by preference they are laid in bare, sandy places, especially on high, dry ground, which is tolerably compact and not loose. It is often stated that they are not laid in meadows and pastures, and that hard road-tracks are preferred; in truth, however, meadows and pastures, where the grass is closely grazed, are much used for ovipositing by the female; while on well-traveled roads she seldom gets time to fulfill the act without being disturbed. Thus a well-traveled road may present the appearance of being perfectly honey-combed with holes, when an examination will show that most of them are unfinished and contain no eggs; whereas a field covered with grass-stubble may show no signs of such holes and yet abound with eggs. In fact, wherever holes are noticed, it may generally be taken for granted that they contain no eggs, for the mother covers well the hole when she has time to properly complete her task. Furthermore, the insects are more readily noticed at their work along roads and road-sides than in fields, a fact which has also had something to do in forming the popular impression. Newly-plowed land is not liked; it presents too loose a surface; but newly-broken sward is often filled with eggs. Moist or wet ground is generally avoided for the purpose under consideration. We have noticed that in the Permanent breeding-region, wherever the vegetation is scant the females show a decided preference for the shaded base of shrubby plants, among the roots of which they like to place their eggs; whereas in the Temporary region, where the vegetation is generally so much ranker, exposed situations, or those comparatively bare of vegetation, are preferred. The experience of 1876 proved very conclusively, also, that they are instinctively guided toward cultivated fields, where the young will find good pasturage; for the eggs were noticeably thickest, and hatched most numerously in 1877 in cultivated areas. In the Cypress Hills region of British America, as Mr. J. G. Kittson informs us, the high lands and protected slopes of the hills are preferred. The soil of the mountain-region, where the insects permanently breed, is mostly of a compact, scantily-covered, gravelly nature, and the notion that they lay most in pure sand is an erroneous one. Sandy soil that is compact, especially when having a south or east exposure, is much chosen, but in loose and shifting sand the eggs would perish. In 1876, it was generally remarked that the insects were more indifferent than usual in ovipositing, and that eggs were much more frequently laid in low, and even wet, land than in former years. The mass seldom reaches more than an inch below the surface, except where some vegetable root has been followed down and devoured, and the insect leaves her eggs before emerging; in this way the mass is sometimes placed a foot below the surface. In abnormal or unhealthy conditions, the eggs may be laid in exposed places without any hole, in which case they doubtless never give birth to young. In other cases, the female will fill her hole almost entirely with the sebific matter. Nor are the eggs invariably laid in the ground, for while we know of no exceptions to this normal position in *spretus*, yet Mr. Boll informs us that around Dallas, Tex., in 1876, the eggs of *differentialis* were very numerously placed under the bark of elm and hackberry logs that had been felled on low lands. We have also received from A. W. Hoffmeiser, of Fort Madison, Ia., some of the eggs of a species of *Stenobothrus*, and the young that hatched from them, the eggs having been thrust into holes made by some carpenter-bee in a fence-post; while *Chlöealtis conspersa* habitually bores in dead wood. The female, when about to lay her eggs, forces a hole in the ground by means of the two pairs of horny valves which open and shut at the tip of her abdomen, and which, from their peculiar structure, are admirably fitted for the purpose. With the valves closed she pushes the tips into the ground, and by a series of muscular efforts and the continued opening and shutting of the valves she drills a hole, until in a few minutes (the time varying with the nature of the soil) nearly the whole abdomen is buried. The abdomen stretches to its utmost for this purpose especially at the middle, and the hole is generally a little curved, and always more or less oblique. Now, with hind legs hoisted straight above the back, and the shanks hugging more or less closely the thighs, she commences ovipositing. When the hole is once drilled there exudes from the tip of the body a frothy, mucous matter, which fills up the bottom of the hole, and bathes the horny valves. This is the sebific fluid which is secreted by the sebific or cement gland. The mucous matter binds all the eggs in a mass, and when the last is laid, the mother devotes some time to filling up the somewhat narrower neck of the burrow with a compact and cellulose mass of the same material, which, though light and easily penetrated, is more or less impervious to water, and forms a very excellent protection. When fresh, the mass is soft and moist, but it soon acquires a firm consistency. During the operation the female is very intent on her work, and may be gently approached without becoming alarmed, though when suddenly disturbed she makes great efforts to get away, and extricates her abdomen in the course of a few seconds, the time depending on the depth reached. The legs are almost always hoisted straight above the back during the process, with the shanks hugging more or less closely the thighs. Sometimes, however, especially when the abdomen is fully buried, the ends of the hind feet may rest firmly on the ground, as has been observed by Mr. Packard in the case of *femur-rubrum*. The time required for drilling the hole and completing the pod will vary according to the season and the temperature. During the latter part of October or early in November, 1876, when there was frost at night and the insects did not rouse from their chilled inactivity until nine o'clock a.m., the females scarce had time to complete the process during the four or five warmer hours of the day; but with higher temperature not more than from two to three hours would usually be required. The soils and locations preferred by the female in ovipositing will be those in which the young will most freely hatch, viz, compact and sandy or gravelly knolls and hillsides, with a south or southeast exposure. The experience of 1877 shows also that hatching takes place very freely in late-mown meadows or prairies, or grazed pastures, where the exposure of the ground permits ready oviposition, and the warmth of the sun. In dry, well-drained, and compact soils of a light nature the eggs are much better preserved than in heavy clays and loams, where they are more subject to mold and rot. The experience of 1877 is rather misleading on this point, and indicates the necessity of generalizing, not from the experience of one, but of many years. The insects were most numerous, and seemed to hatch most numerously in the low lands and in sheltered situations along river-courses. The facts are that in such situations those which did hatch survived in larger proportions than did those which hatched in more exposed places because the former were better protected from the cold rains and storms of spring. Those eggs which are laid earliest the previous year will also hatch earliest, and since, as we have already seen the egg-laying covers an average period of six or eight weeks in the same locality, and lasts generally till frost, it follows that the eggs pass the winter in every state of development—some with the fluids clear and limpid; others with the embryo fully formed and ready at the first approach of spring to hatch. In the same locality hatching will take place—*cæteris paribus*—first on light dry soils and on south and southeast exposures; latest on low, moist, and shaded or tenacious ground. We see, therefore, that the hatching will not alone vary according to temperature and the earliness or lateness of the spring, but that it is quite variable under the same conditions. In every instance there will be a few hatching when the first hatched in the same locality are getting wings, and we give it as a general rule that the bulk of the eggs hatch out in the different latitudes about as follows: In Texas, from the middle to the last of March. In the southern portions of Missouri and Kansas, about the second week in April. In the northern parts of Missouri and Kansas and the southern sections of Iowa and Nebraska, the latter part of April and first of May. In Minnesota and Dakota, the usual time of hatching ranges from early in May in the southern portions to the third week

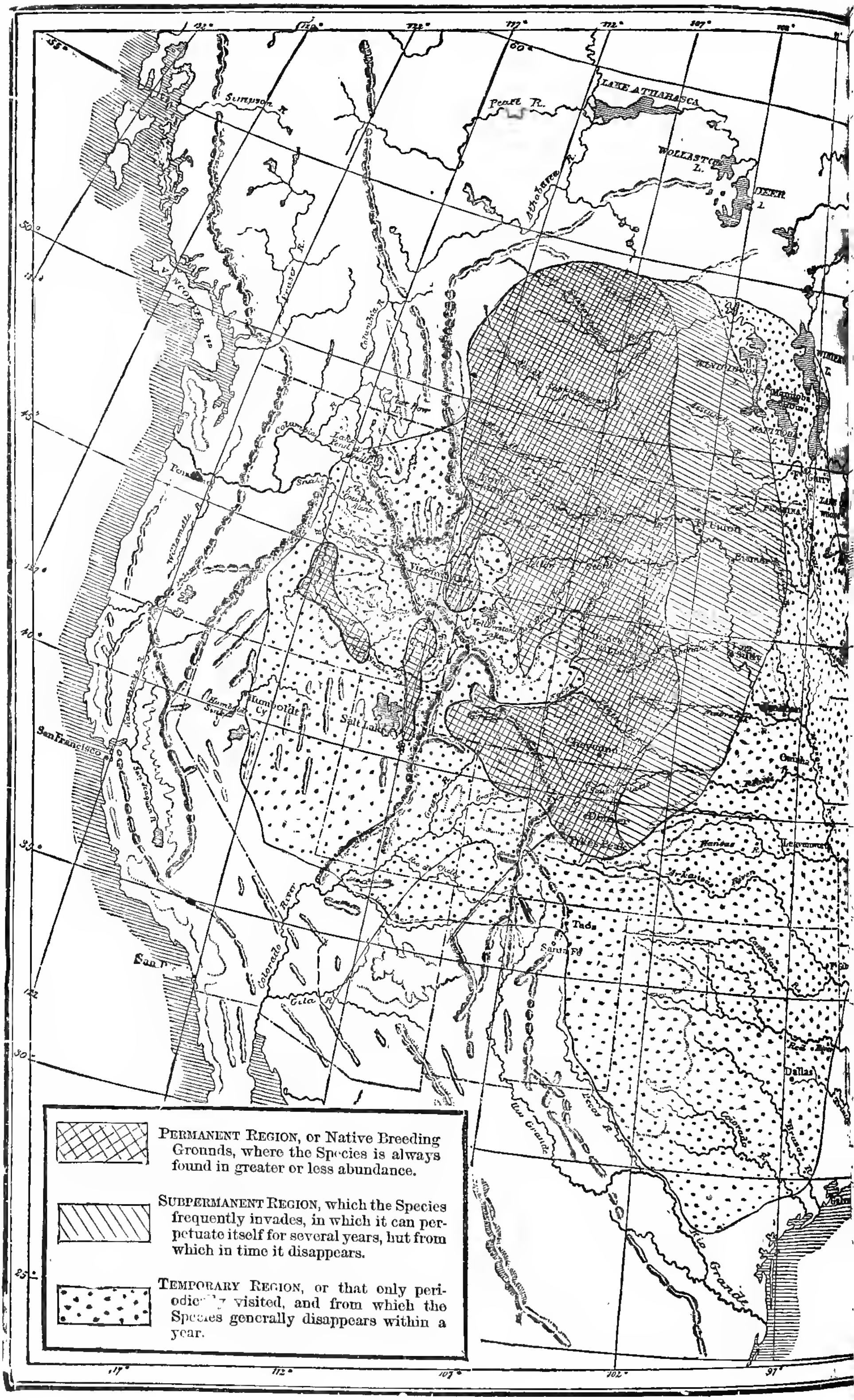


RED-LEGGED LOCUST.

in the northern extremity. In Montana and Manitoba, from the middle of May to the first of June. In short, the bulk of the insects hatch in ordinary seasons about the middle of March in latitude 35°, and continue to hatch most numerously about four days later with each degree of latitude north, until along the forty-ninth parallel the same scenes are repeated that occurred in southern Texas seven or eight weeks before. The summary of our present knowledge of the locust is as follows: The eggs are laid an inch below the surface of the ground in July, August, and September, as the latitude varies; and the young hatch in April and May, becoming fledged in about seven weeks from early in June until the last, swarming from the first of July until the last of September. Birds and insects eat the eggs and young, and a mite, Tachina fly, and hair-worms infest the adults. While the Rocky Mountain locust occurs permanently on the eastern slope of the Rocky mountains, on the high, dry plateaux between 4,000 and 7,000 feet elevation, the district liable to its periodical invasions is between latitudes 30° and 52°, and longitudes 102° and 93°. It occurs, though of smaller size, in California and New England, and probably in British America from the Atlantic to the Pacific. Its migrations take place at irregular intervals during or after hot or dry seasons, when immense swarms are borne from the Rocky Mountain plateau by the prevailing westerly and northwesterly winds, sometimes 500 or 1,000 miles into British America, Minnesota, Nebraska, Kansas, Missouri, and Texas, where they lay their eggs. The progeny of the emigrant swarms return the following season in a general northwest direction for at least hundreds of miles, to near the original habitat on the plains. The periodical invasions may after a while be predicted with more or less certainty, should the Government take measures to appoint suitable persons to observe them, or delegate the task to the Weather-Signal Bureau; meanwhile, by the use of the telegraph, the arrival of swarms may be announced several days in advance. In years of plenty in the border States and Territories, grain should be stored up for use in locust years. Preventive measures, such as planting of forests along lines of railroads, around towns and extensive farms; the use of irrigation, oiling ditches and canals, bonfires and prairie fires, rolling the soil, and collection of eggs; bounties to be paid by Government in the Territories, or by the local authorities in the States infested, for the egg-sacs. Co-operation among farmers and others, in resisting the attacks of insects, to be enforced by proper legislation, both in the Territories and border States. We still need more light on the natural history and migrations of the locust, and the United States Government should appoint entomologists, who should study the locust comprehensively for several years in succession. Local entomologists should be appointed for each Territory, and the border State legislatures should appoint salaried entomologists to further study and report on the locust, and serve for a term of years, until the entire subject be studied, and the knowledge thus acquired be freely diffused among the agricultural community generally. In relation to the geographical distribution of the Rocky Mountain locust, a glance at the map, pages 602 and 603, showing the distribution of the Rocky Mountain locust (*Caloptenus spretus*), will show the probable limits within which it will be found. At least there is no probability that the locust will ever afflict farmers east of the limits assigned. The eastern limits have been defined by Professor Riley, for Texas, Indian Territory, Missouri, Kansas, Nebraska and Minnesota, while the northern and northeastern limits have been indicated by Prof. G. M. Dawson. The southwestern limits are somewhat conjectural, but they have been indicated by Maj. J. W. Powell; also the western limits in Nevada and Idaho have been pointed out by Prof. Cyrus Thomas. The range of the small variety (*atlanis?*) in California and British America (Vancouver's Island) has been indicated by Messrs. Edwards, S. H. Scudder, and Dr. Packard; while the eastern range of the eastern variety *atlanis* has been indicated by Messrs. Riley, Thomas, Scudder, and Dr. Packard. The locust area is divided into two regions, one the permanent breeding-places, on the elevated plains among the Rocky Mountains and the great plateau lying east and extending approximately to longitude 102°. Beyond the edge of the great plains are found the temporary breeding places of the locust, which comprise the prairie-lands of the border States as far east as longitude 93° or 94°. (The deeply shaded portions show the permanent breeding places; those shaded with single lines, the sub-permanent breeding places, and the dotted portions, the districts devastated by the migrating swarms in their periodic flights. Editor.) In dealing with this fearfully destructive insect, which has attracted so much notice from the public, and in seeking for remedies against its devastations, it is of prime importance to have a thorough knowledge of its breeding-places, the frequency and extent of its migrations, and to seek for the connection between the direction of the winds and other meteorological phenomena and the flights of the locust itself. The locust is quite or nearly as destructive in Africa, Asia, and southern Europe as in this country, but the laws of their migrations and their connection with meteorological phenomena have never been studied in those regions, and it remains for the United States, with its Weather Signal Bureau, to institute, in connection with the scientific surveys of the West, investigations regarding the nature of the evil and the best means to overcome it. In endeavoring to trace the connection between the migrations of the locust and the course of the winds at different months, the writer has been led into some theoretical considerations which seem to be supported by the facts presented in the unpublished report, and which may be confirmed or disproved by future investigations. The following table, com-



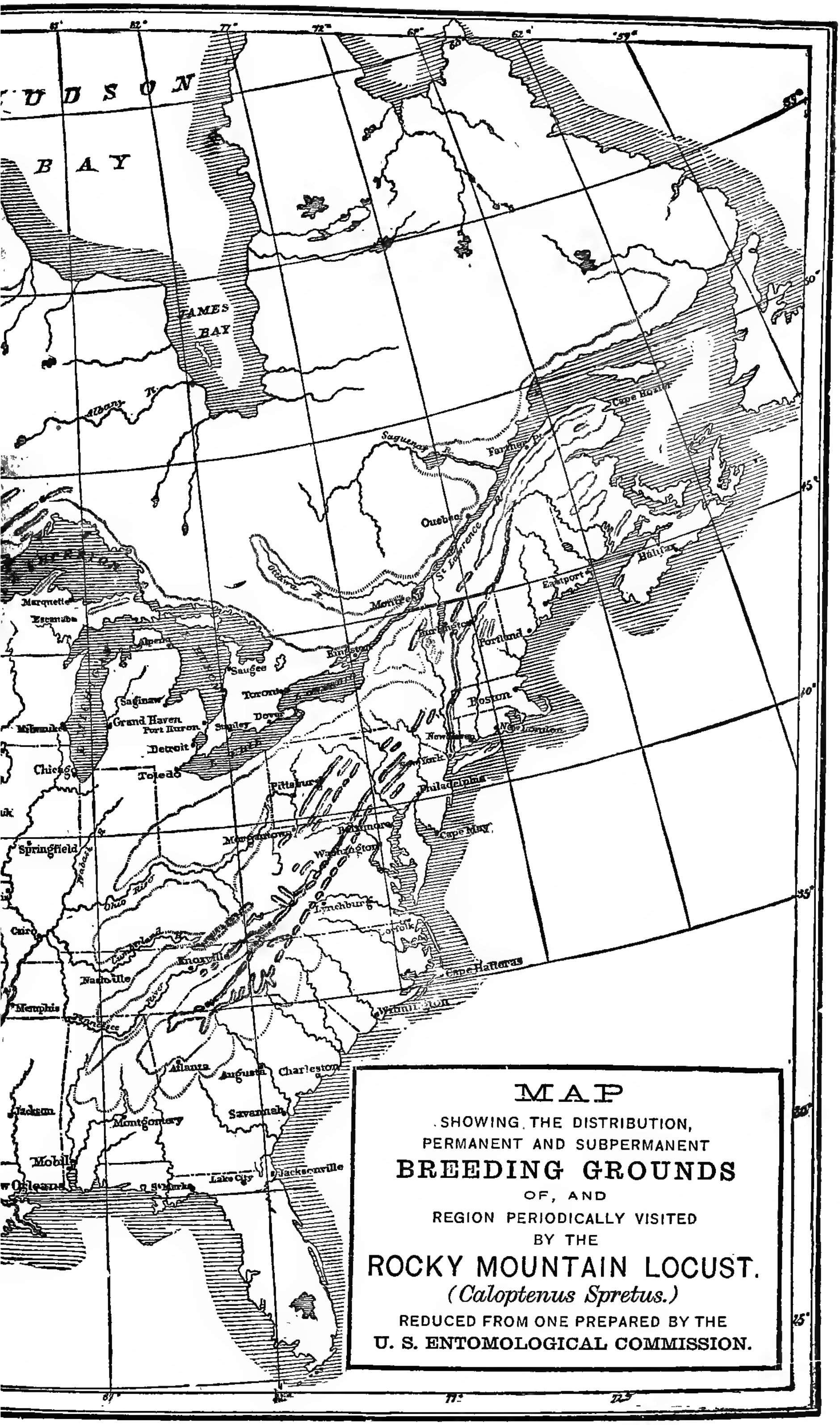
ROCKY MOUNTAIN LOCUST.



▨ PERMANENT REGION, or Native Breeding Grounds, where the Species is always found in greater or less abundance.

▧ SUBPERMANENT REGION, which the Species frequently invades, in which it can perpetuate itself for several years, but from which in time it disappears.

⁘ TEMPORARY REGION, or that only periodically visited, and from which the Species generally disappears within a year.



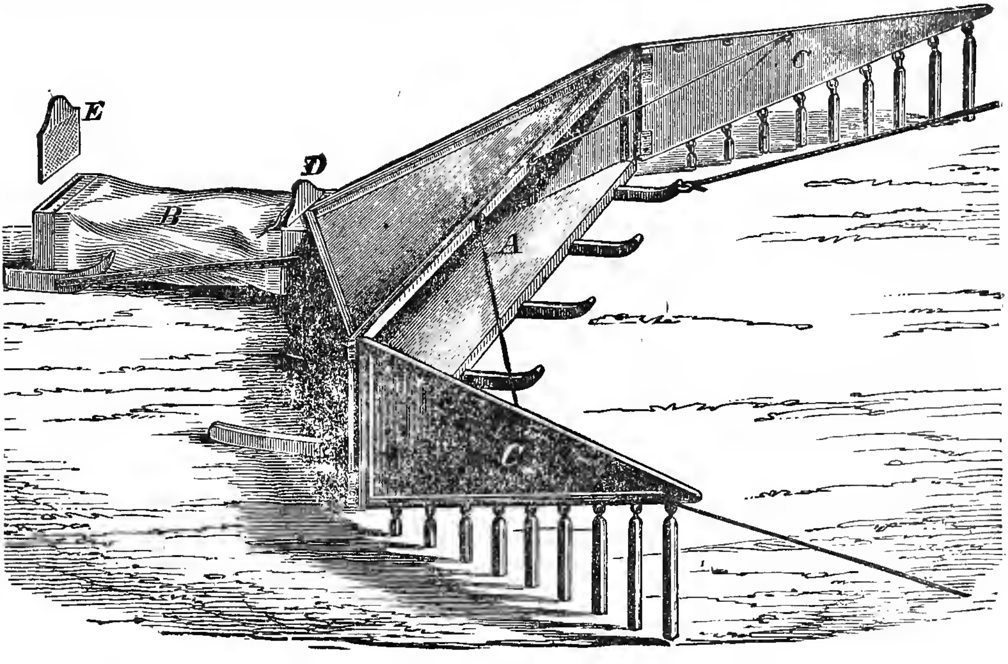
MAP

SHOWING THE DISTRIBUTION,
PERMANENT AND SUBPERMANENT
BREEDING GROUNDS
OF, AND
REGION PERIODICALLY VISITED
BY THE
ROCKY MOUNTAIN LOCUST.
(Caloptenus Spretus.)
REDUCED FROM ONE PREPARED BY THE
U. S. ENTOMOLOGICAL COMMISSION.

piled from the reports of A. S. Taylor, the late Mr. B. D. Walsh, Prof. C. V. Riley, Prof. C. Thomas, Mr. G. M. Dawson, and the observations of Mr. W. N. Byers, together with the reports in the Monthly Weather Review, will show the years when the locust was excessively abundant and destructive in the different Territories and States, and also serve to roughly indicate the frequency and extent of the migrations of the destructive locust of the West. The dates which are starred are years when the progeny of the locusts of the preceding year abounded, and when in most cases there were no fresh incursions from the westward. The species referred to under the head of California, Washington, and Oregon may be some other than *Caloptenus spretus.* This table and the data on which it is based are necessarily very imperfect, owing to the vast extent of the territory over which the locust swarmed, and the fact that the greater portion is uninhabited, while the inhabited portions have been settled only within comparatively few years. It will be seen, however, that since 1873 the evil has been greater and more widespread than ever before. The immediate cause of the migrations of the locust from its original breeding places is the unusual abundance of the species during certain years. It has been found in some cases that the exceptional years when the locust migrates are periods of unusual heat and dryness, conditions unusually favorable to the excessive increase of insect life. As may be seen in the accounts of the eastern locust, the grass-army-worm, the grain-aphis, the chinch-bug, and other less destructive insects, when the early part of the season, the spring and early weeks of summer, are warm and dry, without sudden changes of temperature, insects abound and enormously exceed their ordinary numbers. When two such seasons occur, one after the other, the conditions become still more favorable for the undue development of insect life. Now it is well known that in the Eastern States the summers of 1860 and 1874, preceding the appearance of the army-worm and grain-aphis, were unusually warm and dry, and favorable not only for the hatching of the eggs laid the year previous, but for the growth and development of the larvæ or young. Look now at the conditions for the development of locust life on the hot and dry plains, chiefly of Dakota, Montana, Wyoming, and Idaho. We have no extended meteorological records from these regions at hand, but it is more than probable that the years preceding the migrations of the locusts were exceptionally warm and dry, when the soil was parched with long sustained droughts, as we know that the corresponding species east of the Mississippi river abounds during dry summers following dry and warm springs. Given, then, the exceptional years of drought and heat and the great extent of territory, and we have as the result vast numbers of young hatched out. The year previous having perhaps been warm and dry, the locusts would abound, and more eggs than usual would be laid. These would with remarkably few exceptions hatch, and the young soon consume the buffalo grass and other herbage, and move about from one region to another, following often a determinate course in search of food. In this way large broods may migrate a long distance, from perhaps twenty to fifty miles. In about six or seven weeks they acquire wings. Experience shows that the western locust as soon as it is fledged rises up high in the air, sometimes a thousand feet or much higher. They have been seen to settle at night on the ground, eat during this time, and toward noon of the next day fill the air again with their glistening wings. As more and more become fledged, the vast swarm exhausts the supply of food, and when the hosts are finally marshaled, new swarms joining perhaps the original one, the whole swarm, possibly hundreds of miles in extent, begins to fly off, borne by the prevailing westerly and northwesterly winds, in a generally easterly and southeasterly course. (It should be remembered that prevailing winds from a given direction will deflect the flight of the locusts north or south, according to the intensity and continuance of the winds.—Editor.) Those plants the locusts do not like and which are usually

Manitoba.	Minnesota and Western Iowa.	Montana and Dakota.	Wyoming and Idaho.	Utah.	Colorado.	Nebraska, Kansas, and Western Missouri.	Indian Territory and Texas.	California.	Washington and Oregon.
1818	1818	....	....	....	....	....	....	1827 or 1828	....
1819	1819	....	....	....	....	....	....	1834 or 1835	....
....	1820	....	....	....	....	1820 or 1821	....	1838	....
....	....	....	1845	....	....	....	1845	....	....
....	....	....	....	....	....	1846?	....	1846	....
....	....	....	1852	1852	....	....	18 9	....	1852
....	....	1855?	1855?	1855	1855?	1855	1855	1855	1855
....	1856	....	....	1856*	....	....	1856*	1856*	....
1857	1857*	....	....	1857	....	....	....	....	....
1864	1864	1864	....	....	1864	....	....	....	....
....	1865*	....	....	....	1865*	....	....	....	....
....	....	....	....	1866	....	1866	1866	....	....
1867	1867	....	....	1867	1867	1867	1867	....	....
1868	....	....	....	1868*	1868	1868*	....	....	....
1869	....	....	....	1869	....	1869*	....	....	....
1872	....	....	....	1870	....	....	....	....	....
....	1871	....	....	1871	....	....	....	....	....
....	slight.	....	....	1872	....	....	....	....	....
....	1873	1873	1873	....	1873	....	....	1873	....
1874	1874	1874	1874	....	1874	1874	1874	Southern.	....
1875	1875	1875	1875*	....	1875*	1875	1875	California.	....
....	1876	1876	1876	1876	1876	1876	1876	....	....

cultivated are principally peas and other leguminous species, castor beans, sorghum, broomcorn, tomatoes, sweet potatoes, etc. Such wild plants to which the insects are particularly partial, as tansy, wild buckwheat, etc., might be periodically sprinkled with Paris Green water or powder, so as to kill the young locusts that feed upon them. Such plants might also be sown and encouraged around cultivated fields where the young insects are expected to hatch out. These young will also congregate on timothy in preference to other grasses or grain, and a strip of timothy around a corn or wheat field, to be poisoned in the same way, might save the latter. It is also currently supposed that the common larkspur (*Delphinium*) is poisonous to these insects, but how much truth there is in the statement we are unable to tell. Trapping can easily be accomplished, especially when the locusts are making their way from roads and hedges. The use of nets or seines, or long strips of muslin, calico, or similar materials, converging after the manner of quail nets, have proved very satisfactory. By digging pits or holes three or four feet deep, and then staking the two wings so that they converge toward them, large numbers may be secured in this way after the dew is off the ground, or they may be headed off when marching in a given direction. Much good can be accomplished by changing the position of the trap while the locusts are yet small and congregate in isolated or particular patches. Many machines have been made for trapping locusts. We illustrate the one invented by Dr. C. V. Riley, which will be found simple and effective. Irrigation is feasible in much of the country subject to locust ravages, especially in the mountain regions, where, except in unusually favorable locations, agriculture can be successfully carried on only by its aid, and where means are already extensively provided for the artificial irrigation of large areas. Where the ground is light and porous, prolonged and excessive moisture will cause most of the eggs to perish, and irrigation in autumn or in spring may prove beneficial. Yet, experiments prove that it is by no means as effectual as is generally believed, and as most writers have assumed to be the case. In pastures or in fields where hogs, cattle, or horses can be confined when the ground is not frozen, many if not most of the locust eggs will be destroyed by the rooting and tramping. The eggs are frequently placed where none of the above means of destroying them can be employed. In such cases they should be collected and destroyed by the inhabitants, and the State should offer some inducement in the way of bounty for such collection and destruction. Every bushel of eggs destroyed is equivalent to a hundred acres of corn saved, and when we consider the amount of destruction caused by the young, and that the ground is often known to be filled with eggs; that, in other words, the earth is sown with the seeds of future destruction, it is surprising that more legislation has not been had, looking to their extermination. One of the most rapid ways of collecting the eggs, especially where they are numerous and in light soils, is to slice off about an inch of the soil by a trowel or spade, and then cart the egg-laden earth to some sheltered place where it may be allowed to dry, when it may be sieved so as to separate the eggs and egg masses from the dirt. The eggs thus collected may easily be destroyed by burying them in deep pits, providing the ground be packed hard on the surface. In the thickly settled portions of Europe, where labor is abundant and cheap, this method may be adopted with some advantage.



THE RILEY LOCUST CATCHER.

but it will scarcely be employed in this country, except as a means of earning a bounty, when, in the more thickly settled sections, it will prove beneficial and give employment to young people and others who have nothing else to do. In relation to the destruction of the young or unfledged locusts, the commission say: It is with some degree of pride that we point to the fact that this part of the locust problem is solved. The experience of 1877 has added much to our knowledge of the practical and feasible ways of destroying the young locusts, and has firmly established the fact which we had previously maintained, that, with proper means, effort, and co-operation, the farmer, in the more fertile and settled portions of the country liable to their injury, may successfully cope with them; that, in short, he can protect his crops against them with about as little labor and expense as he must annually employ to protect most of these same crops from weeds. Farmers themselves were surprised at what could be accomplished by well-directed, intelligent effort; and it was the almost universal testimony that there need be, in future, no serious fear of the young insects, even where little effort has previously been made to destroy the eggs. In the destruction of the young, no methods that will not sweep them away in wholesale fashion have any value for our Western farmers, however valuable they may be to the owner of a small flower or truck garden. It is for this reason that we have been able to profit so little by European methods, and have had to invent means suitable to our broad Western fields and the extensive nature of our farming operations. The best that most European authors can advise is the killing of the insects with flattened implements or brush; while Gerstäcker and other writers devote page after page to prove the superiority over other methods of catching the insects with hand nets—a method which, while doubtless of some utility in dense German settlements, would prove absolutely futile on our large and scattered prairie-farms and against the excessive numbers of the pests which our farmers have to deal with. While, therefore, we shall mention all available means that have been or may be employed, we shall devote more especial attention to those which are useful in a broad and general way in the field. Experience has shown that the results of any particular measure will vary in different regions, dependent, to some extent, upon the nature of the soil, the condition of the crops, and the general characteristics of indigenous vegetation. Circumstances may also render some particular measure available and profitable to one farmer where it would be unprofitable to another. For convenience, the means of accomplishing the desired result may be classified into: Burning, crushing, trapping, catching, and use of destructive agents. Burning is, perhaps, the best in prairie and wheat-growing regions, which compose the larger part of the area subject to devastation by this locust. In such regions there is usually more or less old straw or hay which may be scattered over or around the field in heaps and windrows, and into which the locusts, for some time after they hatch, may be driven and burned. During cold or damp weather they congregate of their own accord under such shelter, when they may be destroyed by burning, without the necessity of previous driving. Much has been said for and against the beneficial results of burning the prairies in the spring. This is chiefly beneficial around cultivated fields or along the roadsides, from which the locusts may be driven, or from which they will of themselves pass for the shelter the prairie affords. Scarcely any eggs are laid in rank prairie, and the general impression that locusts are slaughtered by myriads in burning extensive areas is an erroneous one, at least in the Temporary region. In burning extensive prairies after the bulk of the locusts hatch, the nests and eggs of many game birds are destroyed; but as the birds themselves escape destruction on the wing, they may and do return and nest again, while, on the contrary, many injurious insects, like the chinch-bug, for instance, are killed, so that, even leaving the locust question out of consideration, the burning proves beneficial by exterminating other noxious insects, and has some advantages from an agricultural point of view. As locusts disperse more and more from their hatching-grounds into the prairie as they develop, burning the grass in spring is beneficial in proportion as it is delayed. Machines for burning have been used in several localities with considerable success. Mr. J. Hetzel, of Longmont, Col., has employed a machine drawn by horses. It is twelve feet long, from two to two and a half feet wide, made of iron, and set on runners four inches high. An open grate on the top of the runners is filled with pitch-pine wood, a metal sheet covering the grate to keep the heat directed downward. The grate is generally made with a net-work of heavy wire, such as telegraph wire. Two men and a team can readily burn from ten to twelve acres a day, and kill two-thirds of the insects, but for this it requires a hot fire. Hand-burners, consisting of any form of pan or grate, or wire sieves, with handle attached, to hold combustible material, will do excellent service in gardens and small inclosures. There is another method by which large numbers of locusts can be burned, consisting merely of a bundle of rags or tow, which, after being attached to long wire or iron rods and saturated with kerosene, can be ignited and carried over the field. This method has been quite satisfactorily used in Colorado. A stout wire, say forty feet long, is thoroughly enveloped in rags soaked in coal oil. A small wire is wound around the rags to keep them in place, and the simple device is complete. Two men carry this rope, after setting fire to the rags, across the field to and fro until the fuel is exhausted; and as it is not necessary to pass over the same ground more than once or twice, a large field of grain can be thus protected during the half hour or so that the rags burn. The effect is that of a miniature prairie fire. To destroy locusts satisfactorily by crushing, can only be advantageously accomplished where the ground is smooth and hard. Where the surface of the ground presents this character, heavy rolling can be successfully employed, especially in the mornings and evenings of the first eight or ten days after the newly-hatched young have made their appearance, as they are generally sluggish during those times, and huddle together until after sunrise. It is also advantageously employed during cold weather at any time of day, since the young when the temperature is low seek shelter under clods, etc. Harrowing in the autumn, or during dry, mild weather in early winter, will prove one of the most effectual modes of destroying the eggs and preventing future injury, wherever it is available. It should be enforced by legal enactment, whenever the soil in any region is known to be abundantly stocked with eggs. A revolving harrow or a cultivator will do excellent service in this way, not only in the field, but along roadways and other bare and uncultivated places. The object should be, not to stir deeply but to scarify and pulverize as much as possible the soil to about the depth of an inch. Where the cultivator is used, it would be well to pass over the ground again with a drag or a brush harrow for this purpose. Some of our correspondents have urged, and with some reason, that wherever land can conveniently be prepared to induce the females to oviposit in it, as by plowing and then rolling when the insects are beginning to breed, such preparations should be made. A subsequent harrowing will be the more easy. In practice, this method will not often be adopted, because it will pay only under exceptional circumstances. Next to harrowing, plowing is one of the most generally available means possessed by the farmer of dealing with locust eggs, and it is well to fully understand how it may be made most effectual in destroying them. As showing something of this, and the depth at which the locusts should be buried, the following series of experiments was made with eggs obtained at Manhattan, Kan., early in November, and similar in condition to those in the first series: Large tin cylindrical boxes, made of different depths, and varying from four to eight inches in diameter, were used; and in order to hasten the result they were kept indoors at the temperature already mentioned. The soil in all the boxes was finely comminuted and kept in uniform and moderately moist condition. It was gently pressed with the fingers, so as to approach in compactness the surface soil of a well-cultivated garden. In each instance the eggs were placed in the center of the box. A large number of eggs were buried at different depths outdoors where they were under natural conditions of soil pressure and temperature. The soil was a tolerably stiff yellow clay, and was pretty well compacted by many heavy rains, after the frost was thawed out. The results of the outdoor experiments comport with those made in the boxes. The eggs being placed at every depth from one to eighteen inches, and each batch covered with a wire screen, the result was accurately determined. All at one inch below the surface hatched; about one-third of those at two inches managed to escape, and none from any greater depth. Examined May 12, they had hatched down to a depth of twelve inches, and worked their way upward, and horizontally, seldom extending more than one inch in the former, or more than two inches in the latter direction. Most of those at greater depths were at that time unhatched. In looser soil they would doubtless have managed to push somewhat further.

LOCUSTA. The inflorescence resembling the spike, but occurring in grasses, the flowers having no calyces, but bracts only.

LOCUST TREE. Of the so called locust trees, there are two genera, first the common locust or false acacia, (*Robinia*). The common locust, *R. pseudacacia*, valuable for its timber and as an ornamental tree, when it escapes the Locust Borer unfortunately generally common through the West. It is, however, said to escape, comparatively well, this pest on limestone soils. Its handsome foliage, fragrant white flowers, and invaluable timber makes it a subject of regret that it should be so almost universally attacked in the West. It is hardy throughout the North and southward to Tennessee, and makes a noble timber tree. The Clammy locust, *R. viscosa*, is a smaller tree found in the latitude of Virginia and south. The twigs and leaf stalks clammy, flowers tinged rose-color, crowded in oblong racemes, pods glandular—vispid. The bristly or Rose-acacia, *R. vispida*, is an ornamental flowering shrub, a native of the mountains of southern Virginia and the South, growing from three to eight feet high. It is cultivated for ornament in the North but requires winter protection The honey locust, (*Gleditschia.*) has two species, *G. triacanthos*, a large tree armed with stout, strong thorns in threes, but varying. The foliage is light and graceful, and the tree peculiar but handsome. It is much valued in the West as a hedge or barrier, hardy and effective where the Osage Orange will not stand. It grows in rich woods from Pennsylvania to Illinois and southwestward. The pods are from twelve to eighteen inches in length, flat, sometimes twisted, and containing a sickish sweet pulp between the seeds. The water locust, *G. monosperma*, is a western tree, found in swamps in Illinois and southwestward, with slender spines, mostly single, pods oval, one-sided and pulpless.

LODICULA. The two minute fleshy hypogynous scales beneath the ovary of grasses.

LOESS. Alluvial formations By the English it is often used for a yellow loam, with chalky concretions.

LOG. A portion of the trunk of a tree.

LOGWOOD. *Hæmatoxylon campechianum.* A small leguminous tree of Central America and the tropics. The central heart wood, deeply stained, from old trees is preferred; the logwood bath is of great service in the production of black dyes, browns, and reds.

LOLIUM. The generic name of rye grass. (See Grasses.)

LOMENTUM. An indehiscent pod resembling a legume, but divided by membranes between each seed.

LONG-EARED SYRIAN GOAT. (See Goats.)

LONG-HORNED CATTLE. A breed of neat cattle now nearly extinct, chiefly distinguished by the length of the horn, the thickness and firm texture of the hide, the length and closeness of the hair, the large size of the hoof, and the coarse, leathery thickness of the neck.

LONGICORNS, LONGICORNE. Coleopterous insects with long antennæ, often longer than the body; they are borers.

LONGIPALPS, LONGIPALPI. A family of short-winged beetles, with the maxillary feelers (*palpi*) almost as long as the head.

LOOPERS. Caterpillars of the family *Geometers.* (See Span-worms.)

LOOSESTRIFE. Small weeds of the genus *Lysimachia;* they are wholesome. The creeping loosestrife, or money wort (*L. nummularia*,) is said to be a good remedy against insects, when steeped in oil and sprinkled over the granary floor.

LORE. In ornithology, the space between the bill and the eye, which is bare in some birds, as the great crested grebe, but is generally covered with feathers. In entomology the term is applied to a corneous angular machine observable in the mouth of some insects, upon the intermediate angle of which the mentum sits, and on the lateral ones the cardines of the maxillare, and by means of which the trophi are pushed forth or retracted, as in the hymenopterous insects.

LOSS OF CUD. (See Cud, loss of.)

LOTION. An external wash: it may be evaporating (spirituous) or watery. Indolent sores require stimulating lotions; painful wounds, anodyne lotions, etc. Lotions are also used to discuss tumors and inflammations near the skin.

LOUSE. (See Lice.)

LOUSEWORT. *Pedicularis Canadensis.* An insignificant perennial, herbaceous weed; the rattle.

LOVAGE. *Ligusticum levisticum.* A perennial (biennial), herbaceous, disagreeable aromatic plant, of the family *Umbelliferæ*, the seeds of which are used as medicine in flatulence.

LOVE APPLE. Tomato.

LOVE GRASS. A small grass, ornamental, with pretty spikelets, *Eragrostis.*

LOW CLOVER. (See Clover.)

LUCAMA. A Chilian fruit resembling, in size and flavor, a peach.

LUCERNE. *Medicago.* There are several varieties of *Medicago* (medick) cultivated as *M. sativa*, or lucerne; *M. lupulina*, or black medick or nonsuch; *M. maculata*, or spotted medick; and *M. denticulata*, or denticulated medick. The first only is useful in the United States. Lucerne, called generally Alfalfa in the United States, is a most valuable forage plant for warm climates. It is extensively cultivated in California and should be in the South. It delights in a loose, deep, sandy soil, but also does well in dry, deep, loams, rooting deeply, and after being established stands any amount of drought. It will not thrive well in the climate of the North, but from Kentucky south it is a most valuable forage crop. Given rich, clean, and dry land, it will, after the first season, furnish an enormous amount of forage for farm stock, who learn to eat it with avidity. The roots are sought after by hogs who follow them to great depths. In climates that do not freeze severely, as in California and the South, it may be cut five or six times a year. When it begins to fail at the end of several years, it may be again renewed by plowing and harrowing the ground thoroughly, when it will immediately spring up from the deep roots. Of its culture South, Rev. C. S. Howard says: On many accounts, lucerne is one of the most bountiful gifts of Nature to the Southern planter. No grass or forage plant in cultivation at the North will yield nearly as much hay as lucerne at the South. In good seasons, and on land sufficiently rich, it can be cut four or five times during the year. An acre of good lucerne will afford hay and cut green food for five horses the whole year. Ten acres will supply fifty head of plantation horses. This can be cut down in a day with a mowing machine. How unwise in the planter, then, to damage his corn by pulling fodder—that most irksome and senseless work of the plantation. A few acres of lucerne would save him this labor, and the tedious time occupied in pulling fodder could be employed in the improvement of his land. It is useless to attempt the cultivation of lucerne on poor land. It will live, but it will not be profitable. There are certain indispensable requisites in the cultivation of lucerne. The ground must be good upland; it must be made very rich; it can not be made too rich. If the ground is as carefully prepared for it as an asparagus bed, the lucerne will spring almost with the rapidity (after cutting) of asparagus. It must be very clean. When the lucerne is young it is delicate, and may be smothered with the natural weeds and grasses of a foul soil. Land which has been in cotton, worked very late, if made sufficiently rich, is in a good state of preparation for lucerne. The manure put upon it must be free from the seeds of weeds; hence, a mixture of guano and phosphatic manures would be an excellent application. On this farm, land designed for lucerne is put in drilled turnips well manured and worked. The turnips are folded with live stock—that is, they are fed on the ground, which thus gets all the solid and liquid excrements of the animals, and becomes very rich, and is also very clean. Great depth of cultivation is necessary in preparation of the soil for lucerne. If the ground was broken up with a four-horse plow, and in the same furrow a two-horse subsoil plow was run, stirring it eighteen or twenty inches, it would be to the advantage of the subsequent crops of lucerne. Ten pounds of seed are required for an acre, sowed broadcast. Drilling is unnecessary if the ground be properly prepared and the lucerne is not pastured. If the preparation has been imperfect, and the lucerne is to be occasionally pastured, it is better to drill at such a distance as will allow a narrow plow to be passed between the rows when the surface requires stirring. Either early in autumn or early in February are good seasons for sowing lucerne. The seed should be lightly harrowed in, and then the surface should be rolled. Lucerne lasts a great number of years, the roots ultimately becoming as large as a small carrot. It should be top-dressed every third year with some manure free from the seeds of weeds. Ashes are very suitable for it. The lucerne field should be as near as possible to the stables, as work-horses, during the spring and summer, should be fed with it in a green or wilted state. As lucerne is much earlier than red clover, it will be found a useful adjunct in hog raising. Hogs are very fond of it, and will thrive on it in the spring, when it is cut green and thrown to them. This extended notice of lucerne is given because it is remarkably adapted to our soil and climate, and is, beyond all comparison, the most valuable plant for hay-making and soiling to the southern planter. It thrives in no part of Europe with greater vigor than it does in the Southern States. The following interesting statement by a gentleman of California, will be of interest: A freshet cut away the bank of a creek, exposing a section of an alfalfa-field. The roots of the plant had penetrated to a depth of from twelve to twenty feet, and were exposed by the washing away of the bank from the surface to the water-line. The diameter of the root at the crown on the surface varies from an eighth to half an inch. They taper gradually to the lower end, from which a cluster of roots or feeders put out. In the section exposed the roots were close together, but entirely disconnected, each one growing straight through the soil to the water, and producing on the surface a luxuriant branch of alfalfa, which keeps green the year round. A farmer near San José sowed three and a half acres with alfalfa in February, and in September it was producing feed enough to sustain six milch cows. Up to that time it had been cut twice. He thinks that ten cows may be supported when the grass has become fully established. A gentleman who has noted the cultivation of this plant in California for twenty years has in no instance seen it succeed without irrigation except upon alluvial soils, such as are found in the low flats along the margins of rivers. The conditions of successful cultivation are a friable, mellow, moist soil, easily penetrated by the long tap-roots, which should find a permanent supply of water at a depth of not more than six to eight, and not less than three feet; the land should be thoroughly plowed and the surface-crust well pulverized, and about fifteen pounds of clean seed sown per acre and brushed in, but not covered too deep. The sowing should be just before a rain-fall. (See Supplement.)

LUMBAR, LUMBALIS. Belonging to the loins.

LUMBER. Timber, especially in the rough state.

LUMBRICUS. The generic name of worms resembling the earthworm; some species infest the bodies of animals. The earth worms, when not too numerous, tend to improve the soil by their castings; when over numerous, they eat the roots of plants, and may be destroyed by a heavy salting (twenty bushels to the acre,) or liming, with a summer fallow.

LUNAR CAUSTIC. Nitrate of silver. Prepared nitrate of silver, sold in thin cylinders, and used as a caustic: it is one of the best caustics. A solution is valuable as a lotion in some forms of inflammation.

LUNATE, LUNULATE. Crescent-shaped.

LUNATION. The period from one new moon to another, the synodic revolution.

LUNG FEVER. (See Pleuro Pneumonia.)

LUNGS. The viscus in which air is received, and the blood changed by its presence. The lights, pulmonary apparatus. The substance of the lungs resembles a fine, regular sponge; they are so light as to float on water; the windpipe communicates with every cell throughout the viscus. Common air received is changed in the lungs by an absorption of four per cent. of oxygen, and the substitution of an equivalent of carbonic acid, derived from the blood. This oxygenation, or aëration of the blood, taking place in the lungs, is one of the great functions on which life depends, and can not be interrupted for a minute without injury or death. By this change, black venous blood is changed into the scarlet arterial fluid, which alone is capable of sustaining the wants of the body.

LUNGS, INFLAMMATION OF. (See Pleuro Pneumonia.)

LUNGWORT. *Pulmonaria officinalis.* An exotic, perennial, herbaceous plant. The whole genus are pretty, and readily propagated by seeds.

LUPINE. *Lupinus.* A flowering plant sometimes cultivated in gardens, and extensively cultivated as a forage crop in France, Germany, and the southern portions of Europe. The wild lupine of the United States, *L. perennis*, is common in sandy soils, in which all the varieties delight. The cultivated lupine is tender, and the attempts to introduce its cultivation in the South have not met with favor. The cultivated lupine is an annual, and hence the cost of cultivation will not pay in a country where perennial grasses thrive abundantly. The garden varieties are attractive, and of various colors, white, blue, yellow, and variegated and striped. *L. polyphyllus* is a perennial and nearly hardy. It is of two colors, white and blue.

LUPININE. A gummy matter of lupines. Lupinite, a bitter substance extracted from the leaves of the lupine.

LUPULINE. The yellowish resinous dust hanging about the scales of the hop, on which its flavor and value depend.

LURCHER. A coursing greyhound, with shaggy coat and pricked ears; swift and sagacious.

LURID, LURIDUS. A color of a pale-yellowish purple, frequently associated with poisonous properties in mushrooms and flowers.

LUSUS NATURÆ. A sport of nature. Unnatural form in animals.

LUTE. In chemistry, a pasty matter used to adapt two vessels, or coat their surfaces from fire. Clay, putty, dough, lime, white of eggs, and melted India rubber are variously used for this purpose.

LUTEOLINE. A yellow crystalline coloring matter of weld.

LUTESCENT. Yellowish.

LUXATION. A dislocation of a joint.

LYCOPERDON. The genus of puff-ball mushrooms.

LYCOPODIACEÆ. A family of cryptogamic plants, growing in moist places, and resembling ferns, but with a higher organization, approaching that of the *coniferæ*, or pine-trees; the club moss family. These are low growing plants, generally of moss-like appearance, with solid and often woody stems, thickly clothed with sessile, awl-shaped, or lanceolate, persistent and simple leaves, bearing the two to four-valved spore cases, sessile in their axils; they are represented only by two genera. These are Lycopodium or club moss, with the sporangia scattered in the axils of the ordinary and uniform leaves, which are dark green and shining, rigid about the eight ranked leaves. The other genus is Selaginella, with leaves all alike, equally imbricated, and those of the spike similar. Both the Lycopodiums and Selaginella contain handsome varieties, used in the conservatory and greenhouse. Among the Lycopodiums, native in the North, are the common ground pine, and the common club moss. Among the hardy Selaginellas are the delicate *S. Apers* growing in low, shady places, and resembling a moss or Jungermannia.

LYCOSA. A genus of spiders dwelling in holes on the ground, or in chinks, and pursuing their prey with great activity. The tarantula is of this kind.

LYE. A fluid saturated with potash or other salts.

LYMPH. The fluid of the lymphatic vessels. It is slightly milky, but becomes pink on exposure to air, and divides into a clot and fluid part. It is the surplus nutritious fluid returned from every part of the body to the blood through the thoracic duct.

IMPROVING THE FARM FROM THE PROFITS.

LYMPHANGITIS. This disease is variously known as Weed, and Shot of Grease, and is really an inflammation of the absorbent vessels commencing by inflammation of the lymphatics, or absorbent vessels of the hind legs, and when extending to the cellular tissues it becomes chronic, with swelling of the limb or limbs and permanent effusions. It is usually caused by high feeding and want of exercise, especially if the grooming and care of the stable be neglected Hence it is often prevalent in the stables of some farmers, and especially of horses of a gross habit, thick legged, and coarse porous bones. There will be heat, tenderness, and sometimes the swollen glands can be felt beneath the skin. As the swelling increases, abscesses form and discharge, and once the disorder becomes chronic, the horse will always be liable to a recurrence. In the early stages of the disease the horse should be warmly clothed, and a ball given composed of one drachm of calomel and four drachms of powdered aloes, with syrup and linseed meal sufficient to form the bolus. If the chills and shivering continue, give, as one dose one to two ounces of arnica in warm water as the indications may seem to require, as a stimulant to the skin and whole system. In the hot stage, foment the limb with cloths wrung out of hot water. Keep the bowels moderately loose, and allow an ounce of saltpetre two or three times a day in the water given to drink. Open the abscesses freely with a knife if they appear, and dress with cloths wet with carbolic acid solution, an ounce of acid to a pint of water. The horse having suffered with frequent attacks of Lymphangitis, has the leg permanently thickened. If so, give moderate diuretics and alteratives, as nitre and powdered resin, each one-half ounce, and ten drops of oil of juniper, given as a ball once a day. In connection with this rub the swollen leg with iodine ointment to reduce the swelling.

LYMPHATIC HAIRS. In botany, the transparent hairs on some leaves.

M

MACARONI. The dough of wheat flour drawn out into tubes.

MACE. The envelope of the nutmeg.

MACERATION. The softening of animal or vegetable bodies by immersion in fluids, either water, alcohol, ether, etc.

MACHICOLATED. With parapets projecting beyond the walls, and supported by arches springing from corbels or consoles.

MACULATE, MACULATUS. Spotted.

MADDER. This plant was formerly cultivated to some extent, in the middle portions of the United States, rich, dry, sandy bottom lands being best adapted to its growth, and the production of the roots. These were formerly extensively used for dyeing red, but they are now in a great degree superseded by petroleum dyes. The product is about 2,000 pounds per acre. It is hardly probable that the cultivation of madder will be profitable in the United States; it requires much hand work, and hence, our expensive labor can not compete with the cheap labor of France, Turkey, and India. Madder requires a comparatively mild climate for its growth such as may be found in the latitude of Cincinnati, and South and West. Its manner of cultivation in France is as follows: It is grown from seed in a chalky alluvial deposit, and is sown in beds five or six feet wide, with a space of eighteen inches between the beds. In November of the first year, the young plants are covered two or three inches with earth taken from between the beds. In the second and third years the beds are carefully weeded, and the foliage cut for forage when in flower. The roots are dug in August or September of the third year, and simply cleaned if the earth is dry, but washed if so damp as to adhere. In digging, the earth is loosened by a spade or fork, and the roots are drawn, piled, dried in the open air, and packed in bales. The seed should be perfectly dry and free from fermentation. A ridge of eight or nine inches wide and one inch and a half deep is made with a spade and sowed. At a distance of two inches another ridge, of the same size, is run, having care to cover the seed of the first ridge with the earth taken from the second, and so on to the completion of the third ridge. These three ridges form a platband about three feet wide, separated from each other by a space one and a half feet in width, left as a path for the laborer in weeding. From this path also is taken the earth to cover the plants in autumn, when the leaves are dead. For the sake of economy these paths are sometimes planted with potatoes, beets, etc., but each extra plant should be put far apart. If the earth is well pulverized, instead of the seed being sown, one had better plant roots of the preceding year's growth, as crops obtained from the plants display much finer roots than when raised directly from the seed. But if the ground is not friable, but hard and clayey, the plants would not grow well, and possibly would not take at all. In this case seed must be sown. An acre of madder produces seed sufficient for three or four acres of sowing. For the transplanting of roots, as indicated above, ridges, about three feet wide and three inches deep, are made, and the roots laid therein just free from each other; and between these ridges an uncultivated space is left, as in sowing. The seed is sown, or the roots transplanted, in March, and great care must be observed in keeping the land free from weeds; the paths, also, being attended to in this respect. When the land is dry, from drought, it will be necessary to water it by irrigating the intermediate paths, if possible. Slimy water is preferable to clear water for this purpose. In autumn, when the plants lose their verdure and turn to a grayish tint, they must be covered with one and a half or two inches of earth taken from the paths. In the following spring the clods must be broken with a rake. The madder cultivated in strong, dry soils may be removed in three years, and from wet lands in eighteen months. Thus the madder of the mountain requires three years to mature well, while the "paluds" may be dug in from one and a half to three years. The roots should not be extracted until the seed has been produced. Some cultivators, who are pressed for the moneyed results of their labors, do not wait for the seed; but the madder thus prematurely gathered is of an inferior quality. The ramifications of the stalk are first cut, dried, and threshed for the seed; the straw, or refuse, is saved as fodder for cattle. The roots are then dug with the spade or fork, and as their length will average one and a half feet, it can be seen that their removal leaves the land in a prepared state for some other crop. When dug they are spread on the "aire," usually a level, paved spot of ground, where they are dried by the action of the sun and air. When the larger roots may be easily broken, they should be heaped up, so that the smaller tips, (*pettis couts,*) may become thoroughly dry. Care must be taken that this place be free from dampness. When the roots are sufficiently dry they are embaled and sent to the manufacturers, where they are stored in a well ventilated granary. It is taken from the granary in proportion to each day's demand, and, having caused it to lose fifteen or sixteen per cent. of water in a drying oven, it is passed under a large mill-stone and ground to powder. The bolters keep the coarser portion for a second grinding.

MADEIRA CIDER. Mix new cider with honey until it bears an egg, boil in a copper kettle for one quarter of an hour, skim, cool, barrel, and, in March, bottle. It will be as strong as Madeira wine in six months.

MADEIRA NUT. A nut belonging to the walnut (*carya*) family.

MADIA. *Madia sativa.* Sometimes called Gold of Pleasure. A composite plant inhabiting South America, the seed of which yield an abundance of good table oil. It is extensively cultivated in Germany, is a summer crop, maturing in 127 days from seed.

FLOWERS OF MAGNOLIA SPECIOSA.

MAGGOT. The larva of dipterous and other insects. The fly in sheep.

MAGMA. A thick fluid, or mud. Thick, feculent matters from solutions.

MAGNESIA. One of the primitive earths having a metallic basis. It is an oxide of magnesium. It is sometimes found native, nearly in a state of purity; but it is generally prepared by calcining the common carbonate of magnesia. It is inodorous and insipid, in the form of a very light, white, soft powder, having a specific gravity of 2.3. It turns to green the more delicate vegetable blues, and requires for its solution 2,000 parts of water at 60°. It is found combined with carbonic and other acids in plants. It is a useful purgative in an acid state of the stomach; and taken daily, with short intervals intervening, it is a useful preventive of red gravel or lithic acid deposits in the kidneys.

MAGNESIUM. The metallic basis of magnesia; it is bright and white like silver.

MAGNESIAN LIMESTONE. Limestone rocks containing magnesia; they abound above the coal formation.

MAGNETIC NEEDLE. A small bar or needle of steel, fully magnetized, and suspended or supported so as to move freely over a card divided into the points of the compass. It is much used by surveyors to take down the bearing of the fences and other lines of a farm.

MAGNETISM. The electric fluid manifesting itself on a metallic body; iron, cobalt, and nickel are magnetic metals.

MAGNOLIA. The magnolia is one of the most magnificent of the flowering trees of the United States, being handsome in the tree and leaf, elegant in its bloom, and exceedingly fragrant. Unfortunately none but the more inconspicuous are hardy in the West, north of the latitude of Tennessee. In Nashville, Tenn., we have seen large trees of Magnolia Grandiflora, in the yards of citizens, the leaves scarcely browned by the winter. In the Gulf States, its native home, this splendid species is a common tree of the open forest. Even of those called hardy, none of them are so in the West, much north of the latitude of St. Louis. The Umbrella tree or magnolia, *M. umbrella;* the Cucumber tree, *M. acuminata,* and the small or Laural magnolia, *M. glauca,* are the most hardy. The Great-leaved magnolia, *M. macrophylla,* is a native of southeast Kentucky. The Ear-leaved magnolia, *M. Fraseri,* is found in Kentucky and Virginia, and south along the entire range of the Alleghanies. *M. cordata* is the great Cucumber tree of Georgia, and *M. Grandiflora,* the great Laural magnolia of the Gulf States, are the evergreen species. There are many hybrid sorts that have been produced by florists, none, however, worthy of attention that are hardy in the North. As among the so called hardy varieties, we give a cut of the flowers of *magnolia speciosa,* a Chinese hybrid, called Showy-flowered magnolia, the flowers of quarter size. The flowers are handsome, late, and hold their bloom well, and the tree is one of the hardiest of the foreign varieties. Nevertheless, we should not advise the planting even of the hardy varieties north of 40°, except in peculiar situations, as for instance Rochester, N. Y., and the fruit region of the eastern shore of Lake Michigan.

MAGPIE. Nuttall, Bonaparte, and Swainson regard the magpie of America and Europe as identical, and Audubon approved their judgment. Its range is generally throughout Europe, but in this country it is restricted to the western and northern regions. It is stated by Dr. Richardson that it has not been seen nearer to the Atlantic on this continent than the head of Red River, in Louisiana. It dwells in the fur countries of the North in winter as well as in summer, and is a common resident of the interior of Texas, western Louisiana, Arkansas and Missouri. It suffers from the want of food, but not from cold, in high northern latitudes, where travelers have been almost unable to protect their galled horses from its assaults. Unlike the magpie of Europe, it then has little fear of man, the young especially coming to his encampment or habitations, and greedily devouring whatever food they can obtain, even from his hands. The raven is often its companion, but the crow is not found with it. In the central table-land of the Rocky mountains, the nests of the magpie may be seen, usually in low thick bushes, barricaded over and floored with interlaced twigs; and it is common near Monterey, in California. Its common call is pay, pay, and when approaching each other, they practice a low chatter, but utter a monotonous and gluttonous croak while eating. The accounts of the habits of the European magpie, given by Macgillivray, is recited by Audubon in treating of the American bird. He states that its food consists of testaceous mollusca, slugs, larvæ, worms, young birds, eggs, small quadrupeds, carrion, and sometimes grain and fruits of different kinds, in search of which it frequents the fields, hedges, thickets, and orchards; it occasionally visits the farm-yards, prowls among the stacks, and perches on the house-tops, whence it sallies to examine any attractive spot. It is probably unjustly accused of picking out the eyes of lambs and sickly sheep; but it eats eggs, or the young of chickens or ducks, when the old are not present to repel it. Its more wary character, in Europe, is the result of the persecution it experiences because of its depredations. The magpie walks like the crow, but often leaps in a sidelong manner. It is prompt to apprise its companions of the approach of danger, which it does by a chatter indicating its own fears. The eggs of this species are from three to six in number, and vary in form and color. In general they are regularly ovate, or a little pointed, more than one and a half inches in length, and nearly or quite an inch across. They are frequently pale-green, freckled all over with umber-brown and light purple, and sometimes pale blue, or bluish-white, or greenish-white, with smaller spots and dots of the same dark colors, so as very nearly to resemble the eggs of the jay, which, however are smaller.

MAHALEB. A species of cherry, used as a grafting stock; the fruit affords a violet dye.

MAIDEN HAIR. Ferns of the genus *Adiantum*, a beautiful race.

MAIZE. *Zea Mays.* Corn, Indian corn. To the American ear, the word corn signifies that important member of the grass family, denominated, outside the United States, among English speaking people, Indian corn, (the word corn in Great Britain being the term used to designate grain generally). It is a plant of prime value, rivaling rice and sugar cane, in its importance to the human family at large, and in the United States standing ahead even of wheat, in money value, and in the number of bushels produced yearly, exceeding wheat nearly four times. It is a very important article of consumption alike for man and beast and is, indeed, the staff of life to the poorer classes in the South, where it is in more general use as an element of human food than in any part of our country. Botanically the corn plant is a most interesting one. The staminate flowers, (tassel) are arranged at the summit of the plant where their pollen may fall upon the pistillate spikes, (ears) below; these are dense spikes covered with sheaths of abortive leaves, the husks, which often have their blade more or less developed. The silk of the ear is the elongated pistils, one of which proceeds from each ovary or kernel. The cob is the thick rachis, and the chaff which covers it the glumes and paleæ. From the lower nodes or joints aërial roots are often thrown out, imitating in an humble way the celebrated Banyan-tree. The juice of the stem, before the grain is perfected, contains a considerable amount of saccharine matter, and sugar has been obtained from it. The young ears of some varieties have much sugar, which is changed to starch as the grain ripens. In the varieties known as sugar corn much sugar remains unchanged and gum is also a constituent. Under the words corn and Indian corn, in this work, we have referred to the word maize as designating corn, and this to prevent confusion to others than American readers, and for reasons explained in this article. Maize is a native of South America, but before the discovery of America had become pretty generally distributed among the wandering tribes of Indians in the temperate regions of North America. Although a tropical plant and of course exceedingly sensitive to frost, even the late varieties will ripen where there is about five months of summer without frost, and the earlier varieties in 100 days. Cultivation and climate has broken this remarkable grain up into numerous varieties, of every color from dark purple through the reds and yellow to white, and varying remarkably in their constituents of starch, sugar, gum and oil, some, as the dent varieties of the West and South, producing large quantites of starch, others, as the flint varieties of the East having gum and oil notably. Those varieties denominated sweet corn, being especially rich in gum and sugar. The stalks of all the varieties are rich in saccharine when the grain is in milk. So much so that sugar in notable quantities has been produced therefrom, not however in quantities to warrant working it, since, in the South, the true sugar cane, and in the North the varieties of sorghum are more profitably worked. Indian corn may be properly divided into four distinct groups. The Flint corn of the sea coast States, the Dent corn of the West and South, the Sugar varieties containing gum, sugar, oil, and but little starch, and the Squaw or flour corn. The varieties being marked by their tenderness, the skin being filled with starch granules which readily break into powder, the flint varieties contain largely of gum and oil, and the dent varieties as largely of starch and oil. The analysis by M. Payen given below shows the amount of proximate principles of maize as compared with the other cereal grains:

100 parts of—	Starch.	Gluten and other azotized matter.	Dextrine, glucose, etc	Fatty matters.	Cellulose.	Mineral matter and salts.
Wheat..........	58.12	22.75	9.50	2.61	4.00	3.02
Rye	65.65	13.50	12.00	2.15	4.10	2.60
Barley..........	65.43	13.96	10.00	2.76	4.75	3.10
Oats............	60.54	14.39	9.25	5.50	7.06	3.25
Maize	67.55	12.50	4.00	8.80	5.90	1.25
Rice	89.15	7.05	1.00	.80	3.00	.90

As showing the constancy of species in retaining characteristics for long ages under cultivation, where no especial means were used to change them by special cultivation, we give three illustrations. Fig. 1 shows a cob of Indian corn from a rock cave of Arizona; Fig. 2, the corn of the present time as cultivated by the Puebla Indians of Arizona; Fig. 3, an ear of corn found with a mummy of Ancient Peru, the date being so far distant that the age can not even be guessed at. To return to Indian corn of the present day, Dr. Emil Wolff, makes the plant, cut early, or just at the time of blossoming, to contain in 100 parts: water, 82.2; organic matter, 16.7; ashes, 1.1. Or, of nutriment containing nitrogen 1.1; nutriment not containing nitrogen, 10.9; woody fiber, 4.7; total nutriment, 12.0. Or, again, fat 0.5; phosphoric acid, 0.08; lime, 0.07. The total amount of nutritious matter exceeded that of Swedish clover, peas, vetches, oats and lucerne, cut when in flower, as it also did the leaves of cabbage, beets and carrots. As compared with the common English field turnip, the per centage of flesh forming nutriment is the same, of fat forming material nearly double, as between the maize plant, and turnips, while the amount of water in the green stalks and leaves is less than half as much, a curious and interesting comparison, considering that the turnip is the sheet anchor of English husbandry. Maize is the real fallow crop of the West. It was once, and should now be, the fallow crop of American husbandry, both North and South. From many analyses made by Mr. J. H. Salisbury, of New York, the following is the average, of the whole plant calculated without water, and just before the formation of the ear;

Sugar and extract..............................	35.00
Matter obtained from fiber by a weak solution of potash....................................	12.00
Dextrine or gum	6 04
Albumen and caseine...........................	7.96
Woody fiber......................................	39.00
Total...	100.00

The analyist as to the value of maize as fodder, says, the plant during tasseling, owing to the very large per centage of sugar and extract, with the respectable quantity of albuminous matter and dextrine which the stalk, leaves, and sheaths contain, must form a very palatable and nutritious fodder. This has been well borne out since, by those who have drilled, cultivated, and fed Indian corn to dairy cows in the West. Those who have persisted in sowing the corn thickly—three to four bushels per acre—and feeding it half grown, blanched and watery, from overdue crowding, hold contrary opinions. If they will drill it, in rows two feet apart, at the rate of one bushel per acre, and cultivate it until it begins to shade the ground, and will feed it from the time the blossom begins to appear until the grain is half grown, it will be found a most valuable and economical forage plant to tide over the dry season in the West, from the middle of July to the middle of August, especially, if they avoid the mistaken idea of sowing the late varieties of Southern corn, and use instead early and more dwarf sorts, especially the medium early varieties of sweet corn. The insects and their larvæ, which infest maize, are rather numerous, and yet with the exception of Wire worms which attack the young plant under ground, the Heart worm which destroys the plant by boring into the heart of the stalk, and the Corn worm which attacks the young ears, they are not common enough to do serious injury. The range of Indian corn is most extensive, reaching from the torrid zone well up into Canada Far north the plant often does not reach four feet in height, the ears being not thicker than a man's thumb, or more than four inches in length. On the other hand, some of the Southern varieties sometimes reach the height of from fourteen to sixteen feet, with ears as many inches long. It is a curious fact, however, that the largest yields per acre are obtained in the middle region of cultivation, and with varieties neither dwarf nor yet of great height. The corn zone may be stated to lie from the middle latitude of Tennessee and Kentucky to that of central Michigan, southern Wisconsin and northern Iowa, The best climates being the latitudes of Ohio, Indiana, Illinois, southern Iowa, northern and central Missouri and Kansas. The center of corn production and also the center of wheat production since 1850 has moved gradually West, with each recurring decade, the center of wheat production, however, advancing West faster than corn. The center of corn production in 1877 was a line drawn north and south, near the center of Illinois. In another decade, we shall find the center of corn production removed to near the Mississippi river, and that of wheat undoubtedly beyond the Mississippi river. The center of corn production can not travel much further West, for the reason that the dryer climate of the far West is not suited to the production of maize. As showing the wonderful increase in production, we give a table below showing the progress of the production of maize in the last sixteen years, as gathered from the statistics of the United States. It must be remembered that the first three years were years of civil war, with decreased production and inflation of prices. The acreage in the first two years is low, and the price excessive. The year 1865 was a prolific one, with by far the largest average yield reached during the whole period, even in 1879, a year of great crops, giving less than thirty bushels per acre. The acreage of 1865 was nearly doubled in 1866, and nearly tripled in 1878. During the year last named our cornfields were nearly equal in area to the State of Kansas. The average product per acre was substantially the same throughout, amounting to 26.6 bushels during the latter eight years, against 26.8 bushels in the previous eight years. The four crops, 1875-1878, each exceeded considerably a billion and a quarter of bushels. As in the case of wheat, the supplies have grown faster than the population. During the first eight years the outturn averaged 21.40 bushels per capita, and during the latter eight years, 24.07 bushels; in 1875, it amounted to nearly thirty bushels. Our surplus in later years has found an increasing foreign outlet. During the first eight years we sent abroad but 1.20 per cent. of our product; during the latter eight years, 4.37 per cent.; of the crop of 1877, we shipped abroad six and one-half per cent., and of the crop of 1878 in about the same proportion. The average price obtained by the farmer has fallen off two-thirds in fifteen years, being 99.7 cents per bushel in 1864, and 31.8 cents in 1878. The last named crop, though greater by 46,000,000 bushels than

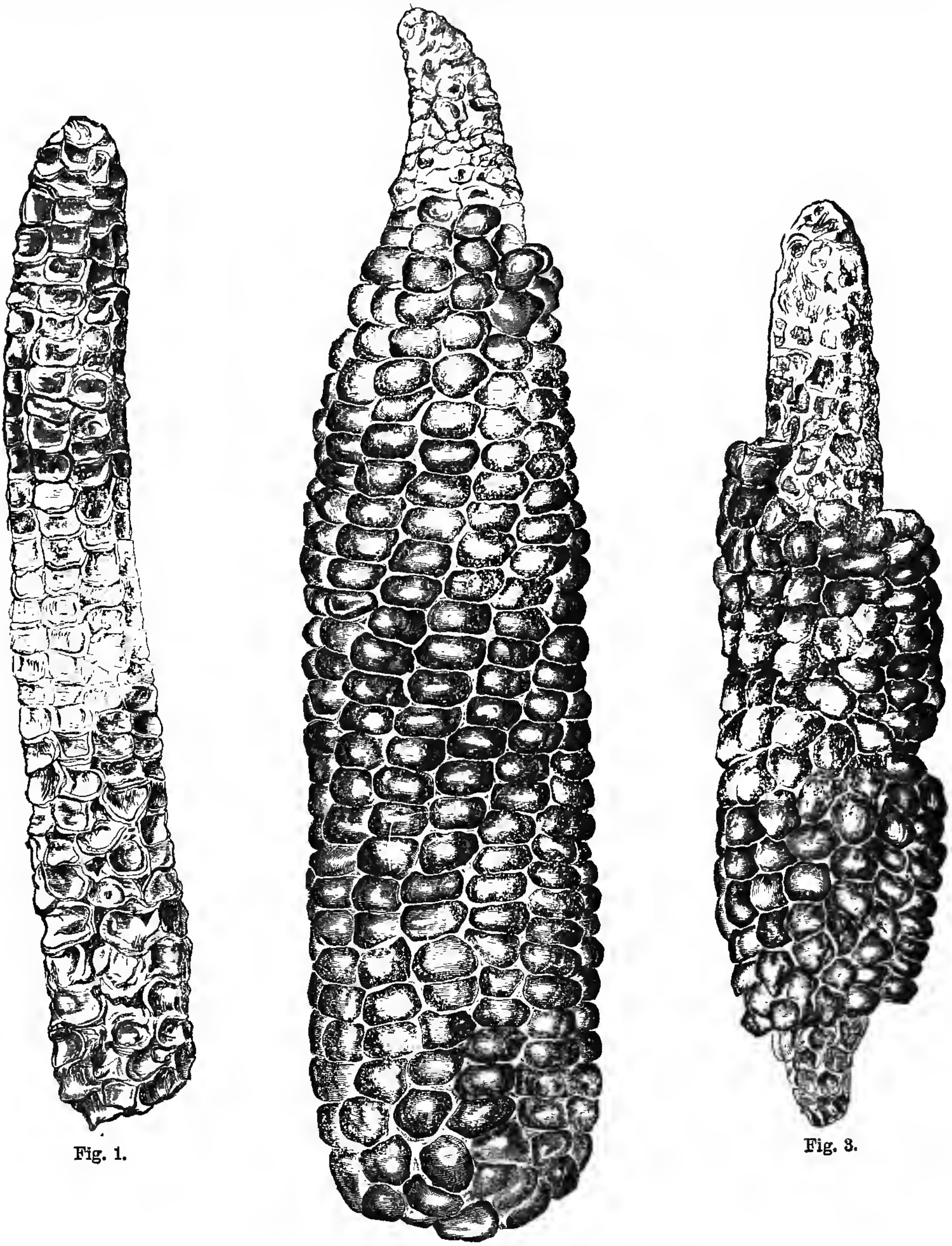


Fig. 1.

Fig. 2.

Fig. 3.

AZTEC INDIAN CORN—PAST AND PRESENT.

its predecessor, fell short of it $39,000,000 in aggregate value. The average value of each acre's yield has fallen to the unprecedented low figure of $8.55 in 1878; in 1864 it amounted to $30.64. The last named year, however, was one of extreme moneyed inflation. The table above will show the production for sixteen years. The corn crop of 1879 aggregated 1,547,901,790 bushels, on 53,085,450 acres, of the value of $580,486,217, or within about $50,000,000 value of the wonderful wheat crop of that year. In 1880 the production of corn was 1,537,535,900 bushels; less than that of 1879. Now as the production of wheat in 1880 was 32,000,000 greater than in 1879, while corn was less, we may conclude, that wheat was more remunerative than corn. It is quite probable that we have already arrived at the maximum production which the country is capable of under an economical system of agriculture, even allowing which is true, that the corn crop is the great fallow crop of the West. It will be seen by the scale representing production and exports, given below, that the years 1875 to 1878 inclusive show an increasing export. Of the crop of 1878, over 100,000,000 bushels were exported, and of that of 1879 still more. One reason why the area of corn production has remained comparatively steady is, that the demand for export wheat has wonderfully increased for the last three years, owing to short crops in Europe. Hence the remarkable increase in wheat production since 1876, as shown in the wheat scale, which has steadily increased including the year 1880. On this page is another table showing the number of bushels, acreage and value of maize, by States, for the year 1878. It will be seen that the four States of Illinois, Iowa, Indiana and Ohio raise about one half the corn grown in the entire country. For the years 1879 and 1880 these figures would be largely increased. It should not be omitted in this article, that the stalks of Indian corn, at that period when they are fullest of elaborated sap will make sugar equal in every respect when refined to cane sugar. Yet it is hardly probable that the making of

Years.	Acreage.	Yield per acre.	Total product.	Price per bushel.	Total value of product.	Total value per acre.	Corn and corn meal exported in the fiscal year closing June 30, following.	Proportion of crops exported.
		Bush.	Bushels.				Bushels.	P. ct.
1863	15,312,441	25.98	397,839,212	$0.69.9	$278,089,609	$18 16	5,146,192	1.29
1864	17,438,752	30.42	630,451,403	99.5	527,718,183	30 26	3,610,402	.68
1865	18,990,180	37.09	704,427,853	46.0	324,168,698	17 07	14,465,751	2.05
1866	33,306,538	25.30	867,946,295	68.2	591,666,295	17 21	16,026,947	1.85
1867	32,520,249	23.63	768,320,000	79.5	610,948,390	18 49	12,493,522	1.62
1868	34,887,246	25.9	906,527,000	62.8	569,512,460	16 32	8,286,665	.91
1869	37,103,245	23.5	874,320,000	75.3	658,532,700	17 74	2,140,487	.24
1870	38,646,977	28.3	1,094,265,000	54.9	601,839,030	15 57	10,676,873	.98
1871	34,091,137	29.1	991,898,000	48.2	478,275,900	14 02	35,727,010	3.60
1872	35,526,836	30.7	1,092,719,000	39.8	435,149,290	12 24	40,154,274	3 68
1873	39,197,148	23.8	932,274,000	48 0	447,183,020	11 41	35,985,834	3.86
1874	41,036,918	20.7	850,148,500	64.7	550,043,080	13 40	30,025,036	3 53
1875	44,841,371	29.4	1.321,069.000	42.0	555.445,930	12 38	50,910,532	3.85
1876	49,033,364	26.1	1,283,827,000	37.0	475,491,210	9 69	72,652,611	5.66
1877	50,369,113	26.6	1,342,558,000	35.8	480,643,400	9 54	87,172,110	6.50
1878	61,585,000	26.9	1,388,218,750	31.8	441,153,405	8 55	…………	…
Average of whole period	35,930,407	26.7	959,174 938	52.3	501,616,287	13 96	…………	……
Average 1863-'70	28,650,703	26.8	768,010,845	67.7	520,309,421	18 16	…………	……
Average 1871-'78	42,210,111	26.6	1,150,341,531	42.0	482,923,154	11 18	…………	……

States.	Corn Crop 1878.		
	Bushels.	Acres.	Value.
Maine	2,180,000	54,500	$1,417,000
New Hampshire	2,207,400	56,600	1,346,514
Vermont	2,275,500	55,500	1,319,790
Massachusetts	1,260,000	35,000	781,200
Rhode Island	268,800	8,400	142,464
Connecticut	2,220,000	75,000	1,376,400
New York	25,020,000	695,000	12,510,000
New Jersey	9,792,000	272,000	4,406,400
Pennsylvania	44,065,000	1,259,000	21,151,200
Delaware	4,500,000	180,000	1,755,000
Maryland	11,209,500	477,000	5,044,275
Virginia	18,200,000	1,040,000	7,826,000
North Carolina	22,603,200	1,662,000	10,171,440
South Carolina	12,276,000	1,320,000	6,629,040
Georgia	24,398,000	2,218,000	14,882,780
Florida	2,124,000	236,000	1,550,520
Alabama	23,928,000	1,994,000	14,117,520
Mississippi	19,474,000	1,498,000	12,463,360
Louisiana	16,875,200	848,000	10,125,120
Texas	58,396,000	2,246,000	25,694,240
Arkansas	22,992,000	958,000	11,036,160
Tennessee	37,422,700	1,939,000	15,343,307
West Virginia	10,118,400	372,000	4,249,728
Kentucky	45,922,100	2,023,000	18,368,840
Ohio	108,643,700	3,113,000	35,852,421
Michigan	31,247,700	835,500	11,874,126
Indiana	138,252,000	4,215,000	37,328,040
Illinois	225,932,700	8,337,000	56,483,175
Wisconsin	36,900,000	984,000	10,701,000
Minnesota	17,106,900	449,000	4,961,001
Iowa	175,256,400	4,686,000	58,041,024
Missouri	93,062,400	3,552,000	24,195,224
Kansas	81,563,400	2,406,000	15,497,046
Nebraska	54,222,000	1,291,000	8,675,520
California	3,467,250	100,500	2,080,350
Oregon	166,600	5,000	153,180
Nevada, Colorado, and the Territories	2,670,000	89,000	1,602,000
Total	1,388,218,760	51,585,000	441,153,405

corn sugar will not become a profitable industry in the United States, notwithstanding the assertions of enthusiasts. It will not supersede the true sugar cane in the gulf States, nor sorghum further north. Nevertheless, it is possible, that some early varieties, rich in saccharine, may be available in prolonging the season of sugar making in the North, by working corn before sorghum is ready for the mill.

MAIZE. (See Corn, in Supplement; also other Cereal Grains.)

MALARIA. The poisonous exhalations of stagnant marshes and low new lands. It is most active at nightfall and during night.

MALE FLOWERS. Such as have stamens only, and no ovary or swelling under the petals.

MALIC ACID. The sour principle of apples, oranges, and numerous fruits; when pure, it is intensely sour and crystalline.

MALIGNANT. Rapidly fatal, poisonous.

MALIGNANT ANTHRAX. (See Blain.)

MALIGNANT PUSTULE. (See Murrain.)

MALLEABILITY. The property of being extended by hammering, as in the case of gold, copper, silver, platina, iron, etc.

MALLENDERS. This is a skin disease attacking horses above the feet, usually back of the knee in the hollow of the joint. If it occur in the hollow of the joint below the hock it is called Sallenders. Technically it is psoriasis of the carpus and tarsus, generally beginning with a moist tetter often difficult to cure. If attended with indigestion and constipation, these must be attended to. The animal should also have light, digestible food, and have an ounce of Fowler's solution of arsenic once a day in the drink. Touch the sore spots lightly with a stick of nitrate of silver, first thoroughly washing with castile soap suds, and drying; then cover with pure wood tar. If it do not heal kindly, cleanse thoroughly and use the following ointment: One drachm powdered camphor, one half drachm acetate of lead, and one ounce mercurial ointment.

MALLOW. *Malvaceæ.* The mallow family includes Althea (*A. officinalis*) being the well known and useful marsh mallow, and the common hollyhock of the garden. The mallow (*Malva*), an introduced weed; Sida, (*S. spinosa*) being an introduced weed from India, and quite common in the South; Abutilon, containing some handsome flowering plants, and the well known *A. avicennæ*, Indian mallow or velvet leaf of the West, a noxious weed in many places; Abelmoschus, of which okra (*A. esculentus*), produces the pods so much in repute South and West as an ingredient in gumbo, and other stews, requiring mucilage; Hibiscus, or rose mallow, to which the shrubby althea or Rose of Sharon, and other elegant flowering plants belong. The family also contains Gossypium, *G. herbaceum*, being the well known cotton of commerce. Cotton and okra are treated of under their separate names. The others may be regarded as weeds, with the exception of marsh mallow, which is a most valuable demulcent. The Indian mallow yields a most elegant fiber, and near Springfield, Ill., its manufacture was at one time actually carried on, but did not prove lucrative, and it was abandoned. The quality of the fiber was superior to hemp, being as strong as manilla, taking colors well, the fiber being valuable as warp for carpets, rugs, and other fabrics requiring color.

MALT. Barley which has been prepared or malted, by which sprouting is induced, and the grain becomes much sweeter.

MALUS. The generic name of the apple.

MALVACEÆ. A natural order of mucilaginous, exogenous plants, with polypetalous flowers and monadelphous stamens. The species are herbs, bushes, or trees, and are found all over the temperate and tropical parts of the world, especially the latter. Their flowers are in many cases large and handsome; but the order is chiefly interesting from the *Gossypium*, or true cotton plant, forming a part of it. Another species is the marsh mallow. Some yield a fiber fit for manufacture into cordage.

MAMMALIA. The study of animated nature with reference to agricultural economy is certainly of importance to the farmer, for thus he learns of those beneficial or noxious. The following will give the principal points relating to the subject, originally written by Mr. E. A. Samuels, of Massachusetts; and from which this is condensed. Taking our terrestrial animated nature, or fauna, and analyzing it we find it to consist of four great classes—mammals, birds, reptiles, and insects. The characteristics of each of these classes, are, of course, familiar to all; they may be described briefly as follows: Mammals are warm-blooded vertebrate animals that suckle their young. They are viviparous—that is, they bring forth their young alive. Birds are warm-blooded vertebrate animals clothed with feathers; they are invariably oviparous—that is, the young are hatched from eggs by the action of heat imparted from the body of the parent bird. Reptiles are cold-blooded vertebrate animals; they are oviparous, the young being hatched by the heat of the sun. Insects are those articulate animals which undergo changes, called metamorphoses, before the perfect animal is formed; these changes are three in number after the eggs are laid; first, the caterpillar stage; second, the pupa stage; and after these the imago or perfect insect stage. The study of the first class is called mammalogy; that of the second, ornithology; the third, herpetology; and that of insects entomology. The study of entomology is undoubtedly of the greatest importance to the agriculturist, but the present paper will not treat of it otherwise than in a general description of the characteristics of the different orders, and incidentally in the enumeration of destructive species which furnish food for some of the mammals and birds. Herpetology is of but little importance to the farmer, as we have but few species of reptiles, most of which are, however, beneficial. Beginning with the great class mammalia, we find it divided by naturalists into different classes called orders, each of which is distinguished by peculiarities in structure, habits, and food. Those orders indigenous to this country among the terrestrial mammalia of importance to the agriculturist, either as beneficial or injurious, are: Cheiroptera, the bats; Insectivora, the insect devouring animals; Carnivora, the flesh devouring animals; Rodentia gnawing animals; Marsupialia, pouched animals; and Ruminantia, animals which chew the cud. Of these animals the Cheiroptera, Insectivora, and Carnivora are beneficial; the Rodentia are generally injurious; and the Ruminantia are valuable only as food, and are, to a slight extent, injurious in the wild state. In the order Cheiroptera are included those animals known as the bats; there are several species in the United States, all of which can be properly included in the family *Vespertilionidæ*, the characteristics of which are an excessive prolongation of the fingers of the anterior extremities, which are connected together, and with the posterior extremities, which are connected with the tail by a thin, semi-transparent, generally naked membrane, which enables them to fly. Their food, which they almost always capture in the night, as the habits of the animals are strictly nocturnal, consists entirely of insects, chiefly nocturnal lepidoptera, which they seize while on the wing. The number of these noxious insects which they destroy is immense; and this fact, together with their harmless dispositions and habits, establishes them as valuable friends to the farmer, who should encourage them to take up their abode on his premises, and protect them as much as possible. At the approach of cold weather, the bats seek convenient quarters in caves, hollow trees, and buildings, where they remain torpid until spring, suspended by the sharp hooked claws of their feet. Of the large and important order, Insectivora, we have many representatives included in the two families, *Soricidæ*, (shrews), and *Talpidæ*, (moles). The shrews may readily be distinguished by their mouse-like form, long and pointed head, diminutive eyes, and attenuated muzzle, prolonged into a movable snout. In the true or typical shrews included in the genus *Sorex*, the body is rather slender, nearly cylindrical, and covered with a soft glossy fur; the ears are large, but nearly concealed by the fur of the head, the eyes are minute, but visible; and the snout is elongated, flexible and sensitive; the tail is variable in length, but generally is long; series of glands are placed along the flanks which secrete a fluid of disagreeable odor, in consequence of which they are seldom destroyed and eaten by the Carnivora. The animals of this family are small, some of them the most diminutive of mammals. Their habits are generally nocturnal, and none of the species hybernate, I believe, as individuals are often seen in winter busily engaged in searching for insects in their various forms, in and beneath piles of stones and rubbish. The shrews inhabit the woods, fields, and gardens, and being possessed of voracious appetites they are continually active in destroying numerous noxious insects, of which their food almost entirely consists; consequently they are all eminently beneficial to agriculture, and are certainly worthy the protection of the farmer. There are also in this country besides the genus *Sorex* or true shrew included in the *Soricidæ*, other genera, of which *Blarina* is the most important. In this genus are placed the mole-shrews or short-tailed shrews. These may be recognized by their stout body, short tail, and the other features of the genus *Sorex*. The family *Talpidæ* (or moles) is represented in this country by several species, in all of which the body is short and strong, the snout flexible and very sensitive, and the head is long and tapering. The external ear is wanting, and the eye is so small as to be hardly visible, or is completely covered with the skin of the head. The limbs are short and strong, (the forward ones which are provided with strong claws for digging,) exceedingly so. These peculiarities of form are all adapted to the subterranean habits of these animals. Their food consists of insects and worms; these, which they destroy in great quantities, are all, or nearly so, captured beneath the surface of the ground. They are almost constantly employed in searching for food in consequence of their voracious appetites, and their labors are valuable in destroying these insects. In reviewing the habits of the different animals that subsist entirely upon insects, we find them to be generally nocturnal in character. This seems to be a wise provision of nature, whereby the birds (generally diurnal in habits) which destroy great numbers of insects, and even in a great many species, subsist entirely upon them, are continually assisted in keeping reduced this formidable and destructive element. Another interesting and valuable fact is, that these animals to make their work the more sure, hunt in different circles: The *Vespertilionidæ* destroying great numbers of insects in the air; the *Soricidæ* on the surface of the earth, and the *Talpidæ* beneath the surface. In studying these beautiful laws, so nicely calculated for so desirable an end, we admire and wonder. Appreciating them, and noting their efficacy, we learn to respect and even love the instruments by which they are executed. The Carnivora, a great order, generally diffused over the entire globe, is represented in this country by the following families: *Felidæ*, (the cats;) *Canidæ*, (the dogs;) *Viveridæ*, (the civet cats;) *Mustelidæ*, (the weasels, skunks, etc.;) and *Ursidæ*, (bears.) The external characteristics of the *Felidæ* are—a rounded head, light, elastic, muscular body, strong limbs and sharp retractile claws on all the toes, which are five in number on the anterior feet, and four on the posterior. In this family are included our panthers, lynxes, and wildcats. The habits of these animals are both nocturnal and diurnal, but generally the former. In capturing their prey they always spring suddenly upon it from some concealed station, and if they fail in their first attack they seldom repeat it. By nature they are cowardly and cruel; they are gifted with acute senses of sight and hearing; they are only beneficial in destroying many of the injurious herbivorous mammals; and it is a doubt whether or not the damage they inflict by destroying great numbers of beneficial birds and valuable ruminants, does not more than balance the little good they do. At any rate the hatred all farmers have for them is so great that they lose no opportunity to destroy them, and, probably, this one of their prejudices is founded on reason. In the family *Canidæ*, are included our wolves and foxes; the same remarks will apply to them as to the cats regarding their usefulness. The family *Viveridæ* has no importance to our agriculturists. The family *Mustelidæ*, in which are placed our martins, weasels, otters, badgers, and skunks, is the most important of the Carnivora to agriculture. Its characteristics are based principally on peculiarities of the teeth, of which these animals have six incisors in each jaw; two canines; six or eight pre-molars; two molars in the upper, and two or four in the lower jaw. Their bodies are generally long and slender; legs short; feet, five-toed, provided with long sharp claws; the tail is generally long, and sometimes bushy, as with the skunks. These animals generally have glands at the root of the tail which secrete a liquid of offensive odor. With the skunks this secretion is used as a weapon of defense; its offensive odor exceeds anything in nature. The weasels and skunks are the most important members of this family; they are continually active in destroying the mice and rats; the form of the weasels being peculiarly adapted to following them to their most secret haunts. Insects also form no inconsiderable portion of the food of skunks and weasels. Birds and their eggs, and young, are often destroyed by them, but not to an extent at all balancing the benefit they do; nor is the injury caused by an occasional raid into the poultry-yard at all comparable to the immense benefit we receive from their unceasing nightly labors in the destruction of rats, mice, and insects. The otters and badgers are of no importance to agriculture. The *Ursidæ*, in which are included our raccoons and bears, are omnivorous in nature, although they are placed by the naturalists in the Carnivora. In consequence of thier depredations in the cornfields and sheepfolds they are in ill favor with the farmers, who improve every opportunity to destroy them. But little can be said of their benefit to agriculture. In closing the order Carnivora it would be proper to say that these animals are slow to multiply. If this were not the case, they would, in consequence of their voracity, exterminate the other animals on which they subsist, (and which are also valuable as food for man,) and thus defeat the object for which they were created. A knowledge of the characteristics and habits of the animals of the order Rodentia is of great importance to the agriculturist, from the fact that these animals constitute one of the most destructive elements with which he has to contend. To properly understand these characteristics, it will be necessary to enter into a more careful and less general examination of the animals, and trust less to external peculiarities than we have thus far done; and we will, as far as possible, simplify these examinations, that they may be brought within the comprehension of all who have not already made the subject a study. The animals of this order are all of small size, the beaver and marmots being among the largest. The species are all very prolific and numerous, and all are destructive, some exceedingly so. The prominent characteristics of these animals is the peculiar formation of the teeth. These are of two kinds, incisors and molars; the canines are wanting; the incisors are generally two in number in each jaw; they are large and powerful, and provided with sharp, cutting, chisel-shaped edges adapted to gnawing. The constant severe action to which they are subjected would in time destroy them were they not continually growing, or being replaced by a pulpy secretion at their bases. The molars vary in number from twelve in the upper and ten in the lower, to but two in each jaw; these, like the incisors, are composed of two substances; an external layer of hard enamel, and a softer material in the interior; their surfaces are irregular or tuberculated, adapted for grinding vegetable substances. These teeth are replaced in the same manner as the incisors. The forms and habits of the animals in this order are of a great variety. They will be discussed in the descriptions of the different families, of which we have in this country five. They constitute each a natural group, with generally familiar representatives. They are called the *Sciuridæ*, (the squirrels); *Saccomyidæ*, (the pouched rats and gophers); *Muridæ*, (rats and mice); *Hystricidæ*, (porcupines); and *Leporidæ*, (rabbits and hares). The detailed peculiarities of these families can not be, in the present paper, discussed at great length, but those most prominent will be mentioned sufficiently to have them understood. The *Sciuridæ* of the United States are included in the two natural divisions or subfamilies *Sciurniæ*, (squirrels and woodchucks); and *Castorinæ*, (beavers). The subfamily *Sciurinæ*, in which are placed the squirrels, both ground and arboreal, the woodchucks and spermophiles is very numerous in this country, and the members of it are generally injurious, from the fact that the great bulk of their food, of which they generally secure large quantities for their winter subsistence, consists principally of the various seeds, nuts, and grains which are valuable as a means of subsistence to man and the domestic animals. These animals also consume great quantities of cultivated fruits, and even vegetables, to an extent, in some districts, involving to the farmer considerable pecuniary loss. Woodchucks, especially, are very mischievous, not only in what they eat, but to the crops of clover, grass, and grains, which are destroyed by numerous trails or paths leading from their burrows. This family is of small value, either for food or for their fur. The *Castorinæ*, or beavers, are of no great importance, economically speaking, to agriculture. They are valuable for their fur, which always commands a ready sale at a high price. These animals are rapidly becoming extinct, and are only found in the wildest and most retired districts of the country. In the family *Saccomyidæ* are included all the gophers and pouched rats. They may be readily distinguished by their large cheek pouches. These animals, are all eminently injurious. They burrow in the earth in grain fields and grass lands, and often do considerable mischief by visiting the gardens, orchards and nurseries, where they eat the roots of the plants and gnaw the bark from the trees. In this manner large numbers of fruit trees are destroyed yearly. The cheek pouches are used in conveying food to their burrows. This food consists of roots, grains, grasses, seeds, fruits and nuts. Of these they devour great quantities. Various methods have been devised for their destruction, the most successful being by poison. Great numbers are destroyed by the carnivorous animals and birds, and were it not for these they would, in consequence of their numbers and rapid increase, be a serious pest. These are, however, not found in New England. The great family *Muridæ* is, economically speaking, the most important in our indigenous *Rodentia*. In it are included the rats and mice, all of which are injurious, in some genera, seriously so. These animals have characteristics in common, but they naturally fall into several groups, which possess peculiarities sufficiently marked to rank them as subfamilies. They are called the *Dipodinæ*, (jumping mice); *Murinæ*, (rats and mice proper); and *Arvicolinæ*, (short-tailed field mice). In the subfamily *Dipodinæ* we have but one genus, (*Jaculus*), in this country. These animals are readily distinguished from the field mice by their very long posterior limbs and tail, and their progression by long leaps. This genus is not a large one, and consists in this country of but one or two species. They are not abundant in any districts, and can hardly, from their retiring habits, and the nature of their food, which consists largely of the seeds of wild plants, be called greatly injurious. Their number will probably be kept reduced by the *Carnivora* and reptiles. The subfamily *Murinæ* is largely and widely distributed. It is characterized by a robust body, moderately short limbs, strong and fully developed clavicle, and the tibia and fibula are united below. The anterior feet are four-toed, with a wart-like tubercle supplying the place of a thumb; the posterior feet are five-toed; the tail is generally long, and covered more or less thickly with scales, which are arrayed in whorls, and between which spring scanty hairs which partially conceal them. In this subfamily are included our common rat, *Mus decumanus*, (Pallas); black rat, *M. rattus*, (Linn.); common mouse, *M. Musculus*, (Linn.); the field mice, (*Reithrodon*); the white-footed mice (*Hesperomys*); the bush rats, (*Neotomia*); and the cotton rats, (*Sigmodon*). These animals are all injurious generally in the highest degree. In the fields and gardens, in the grain houses and hay ricks, their depredations are innumerable, and the farmer has to pay for their support a large share of his produce. These species are all prolific and numerous, and their rapidly increasing numbers are already a serious evil. They should be destroyed at every opportunity. The farmer will find that he will have able and willing assistance in their destruction in one or two small terriers if he keeps them about his premises. They are as natural enemies to the rat tribe as the cats are, and as constantly and successfully on the alert for them. In conclusion, we can say that, with the exception of the *Arvicolinæ*, to be treated of next, they are the most injurious of all mammals. The animals included in the subfamily *Arvicolinæ* are certainly the most injurious of all farm pests, excepting the insects. They are divided into three genera, *Arvicola*, (field mice); *Fiber*, (muskrats); and *Myodes*, (Lemmings). Of these, the last mentioned are not of much consequence agriculturally. Muskrats are very mischievous among crops which lie near their haunts. They ought to be exterminated by every means in the farmer's power, on account of the immense and unceasing injury in cutting through dams and embankments, breaking the banks of ditches, and burrowing in, through, and across drains, opened and covered. It is the animals in the genus *Arvicola* that constitute one of the greatest of farm nuisances. They are characterized, and may be readily distinguished, by a rat-like, but rather stout, form; short ears, nearly concealed in the fur; large head and short tail. They are known in different sections by the names, field mice, short-tailed field mice, bull-head mice and bear mice. These animals are numerous, in some districts extremely so, and prolific to an alarming degree, and exceedingly voracious. In summer they live in the cultivated fields and meadows. In this season they eat the different grains by cutting down the stalks to get at the ears. They also eat the roots and seeds of the different grasses and clover, and devour carrots, turnips, and other vegetables. In the barns and hay ricks they spoil the hay by cutting it into fragments and filling it with their peculiar odor, thus rendering it unacceptable to the cattle. The late lamented Robert Kennicott, who obtained a rich fund of knowledge of the habits of these animals, wrote a valuable report on them, in which he says: Few if any escape their depredations, though the full amount of damage done by them is but little known, and they are usually thought unworthy of consideration. Such farmers as cut their corn and leave it standing in shocks for some time in the field, usually done in the West, will find upon examination that in many, if not in every one of the shocks, there may be found one or more pair of meadow mice, which have dug for themselves burrows in the ground beneath, and have often carried thither a store of corn; while in these, or ensconced in the protecting cornstalks above, they have built themselves a nest, in which they can lead a very comfortable sort of life, regaling themselves when hungry upon the corn. Now, a pair of mice will not, it is true, eat enough corn to alarm a farmer for the safety of his crop; but let any one examine a large field of corn thus cut and left standing on the ground a month or two where these mice abound, and carefully estimate the average amount of corn destroyed in each shock, observing that which has been buried in the burrow, and then multiply that by the number of shocks inhabited by these pests, and it will be often found that they have consumed or destroyed a large amount. In meadows they do much injury by devouring the roots and stems of timothy, clover, and other plants used for hay. In a nursery, where apple seeds were planted in autumn, I have observed that, during fall and spring, so many of the seeds were dug up by these mice as to leave long gaps in the rows of seedlings, the empty shells of the seeds being found lying about the rows from which they had been taken. They congregate in stacks of hay and grain, sometimes in exceedingly great numbers, destroying all the lower parts by cutting galleries through them in every direction. The greatest mischief done by meadow mice is the gnawing of bark from fruit trees. The complaints are constant and grievous, throughout the Northern States, of the destruction of orchard and nursery trees by the various species of *arvicolæ*. The entire damage done by them in this way may be estimated, perhaps, at millions of dollars. If any think this too large an estimate, let them inquire, even in a small neighborhood, where much attention is paid to fruit-growing, and it will be found that, wherever they abound, the injuries committed by these pests are frequently among the most serious difficulties encountered by the pomologist. This is especially the case at the West, where no care is taken to protect the trees against them, careless orchardists allowing grass to grow about the roots of their fruit trees, and thus kindly furnishing the *arvicolæ* with excellent nesting places in winter, and rendering the trees doubly liable to be girdled. Thousands of fruit trees, as well as evergreens and other ornamental trees and shrubs, are at times thus killed in a nursery in one winter. The mice are most mischievous in winters of deep snow. It is usually thought that they only gnaw bark when no other food is to be obtained; but it is more probable that this is palatable to them at all times. Confined specimens, while abundantly supplied with food of all kinds, ate the bark from twigs placed in their cage. One reason why fruit trees are most girdled in times of deep snow is, that the meadow mice can then best move about at a distance from their burrows, being protected by the snow, under which they construct numerous pathways, and are thus enabled to travel comfortably in search of food, always to be obtained in abundance where there is any kind of perennial grass or the seeds of annual plants. Aided by the snow, too, they climb up at the sides of the trees to gnaw the bark at a considerable height from the ground. Rabbits are often accused of gnawing the bark from trees, when the mischief has really been done by meadow mice. If the *Arvicolinæ* had not numerous enemies they would soon become unbearably numerous, for they are all very prolific, rearing several litters of from five to seven in each, yearly. They are destroyed by all the carnivora and rapacious birds. Indeed, some species subsist almost entirely upon them. The animals most efficiently active against them are the *Mustelidæ* and some of the large snakes. These, if protected by the farmer, and they should be, would do much to keep these pests reduced in numbers. They can readily enter the burrows of the mice, and, possessing voracious appetites, destroy great numbers. But the farmer, the moment he sees a snake, no matter if it is perfectly harmless, (and but few are venomous,) kills it, thus destroying one of his greatest benefactors, living as it does on insects principally, but often catching these mice. Domestic cats are also extremely fond of them, and destroy great numbers. In spite of all this destruction *Arvicolinæ* are still abundant. Many farmers kill small birds of prey with a zeal that would be highly commendable if exhibited in a better cause, while the man is rarely found who does not kill the harmless mouse and insect-eating snakes, with as much eagerness as he would destroy the really objectionable rattlesnake, which is the only venomous reptile on the prairie region of the Western States. Let one of our prairie farmers, who regards these pests as inoffensive little mice that only steal a few kernels of corn, investigate their habits carefully for a year, and he will be very apt to conclude that meadow mice are a kind of farm stock that are hardy and excellent breeders, but rather expensive to keep. It may be, he will think it best to forbid killing, too, on his farm the prairie hawks, owls, and shrikes, as well as harmless snakes. Before dismissing the destructive family *Muridæ*, it will be proper perhaps to mention some of the methods that have been adopted on the farm for their destruction, or to prevent their ravages. Numerous traps have been devised, some of them ingenious and effective. Of these, the best we have seen—one for barns and granaries, and another for the fields —are as follows: Place a barrel half full of water beneath a trap-door in the floor of buildings infested with these animals, so that the top of the barrel will be just on a level with the floor; around this scatter grain or meal at night, and by morning numbers will have fallen in and been drowned. In the fields and nurseries where they abound, a trap made on the favorite Scotch plan is very effective. Dig in the earth, at the beginning of cold weather, short trenches four feet wide at the bottom, and three feet wide at the top, and about four feet deep; the ends inclined at the same angle as the sides. The earth walls of these trenches, after becoming frozen, are impassable to mice that have fallen in, as they will in great numbers. It is stated by a Scotch gardener, that he has killed upwards of nine thousand in one winter in this manner. Different poisonous preparations have been used with effect on these vermin. The following are among the best: Two ounces of carbonate of barytes mixed with one pound of suet or tallow; place portions of this within their holes and about their haunts. It is greedily eaten, produces great thirst, and death ensues after drinking. This is a very effective poison, as it is both tasteless and odorless. Mix one ounce of finely powdered arsenic and one ounce of lard with meal into a stiff dough; put it about the haunts of the rats; they will eat it greedily, and it makes them so thirsty that they will die near the water, of which they drink until they burst. Other effective poisons are composed as follows: Make a paste of one ounce of flour, one-half gill of water, one drachm of phosphorus; or, two ounces of lard, half a drachm of phosphorus, and one ounce of flour; or, one ounce of flour, two ounces of powdered cheese-crumbs, and one-half a drachm of phosphorus; add to each of these mixtures, if convenient of access, a few drops of oil of rhodium; mix into a paste or pills, and scatter about the fields and nurseries; or, two ounces of finely powdered arsenic, two ounces of lard, ten drops of oil of rhodium, mixed with flour or meal into a thick dough, and pills of it scattered about the orchards and nurseries. In the family *Hystricidæ*, are comprehended the porcupines, etc. Of these we have but two species included in the genus *Erethizon;* they are the white-haired or Canada porcupine, *E. dorsatus*, (Cuv.,) and the yellow-haired porcupine, *E. epixanthus*, (Brandt.) These animals are not numerous or troublesome; they are injurious only in destroying trees, of which they eat the bark and leaves. Sometimes these trees are found stripped almost entirely of bark, and it is said that a single porcupine will thus denude a hundred trees in a season. They also eat fruits and vegetables, but not to any great extent. In the family *Leporidæ* are included our rabbits and hares. Their characteristics are: long and erect ears; large and prominent eyes; four incisors in the upper, and two in the lower jaw; the two middle ones in the upper jaw much the largest; posterior limbs long and strong, adapted to leaping; anterior feet five-toed; posterior feet four-toed; tail short or wanting. Some of the animals in this family are injurious in gardens and nurseries to an extent hardly appreciated. I have known acres of peas to be destroyed in a few weeks when situated near small swampy woods, in which these animals for the most part reside. Fruit trees are often injured by them, sometimes seriously, by their eating the bark in winter from the trunk; cabbage fields are also visited in the summer, and great damage done. Fields of clover, of which they are fond, are trampled and cut up, if they are near woods, to an extent only known by the enraged farmer. I have seen many of these fields with well-beaten paths running in all directions made by the rabbits and woodchucks. The *Leporidæ* are very prolific; were they not they would soon be exterminated, for they furnish food for man, and are destroyed in great numbers by the carnivorous animals, (especially lynxes, weasels, and foxes,) rapacious birds, and reptiles. The animals of the order Ruminantia have peculiarities that constitute this a very natural group. They have in all the families the following common characteristics: No incisors in the upper jaw, their place being supplied by a calloused gum; eight incisors in the lower jaw; generally twelve molars in each jaw; feet bifurcate. These animals, as their name indicates, chew the cud; that is, they masticate their food a second time. The manner in which this is done is as follows: Their stomach is compound, being composed of four different compartments. The food, which is always vegetable in nature, is but little chewed when passed into the first or largest compartment called the paunch. From this it passes into the second compartment, from which it returns to the mouth where it is completely masticated, and then passed to the third stomach, from that to the fourth, and thence to the intestines. In this order are found two of our most valuable domestic animals—horned cattle and sheep. These animals, in their order indigenous to this country, are included in but two families; *Cervidæ* in which are placed our moose, elk, and deer, and *Cavicornia* which includes the goats and bison. The *Cervidæ* are distinguished by solid deciduous horns; the *Cavicornia* by permanent hollow horns. These animals are all valuable for food, and for their hides, of which different kinds of leather are made. They are generally wild and retiring in their habits, seldom approaching human habitations. The deer in some districts are injurious by visiting corn and grain fields, which they eat and destroy, sometimes to a considerable amount. They also injure young fruit trees in nurseries by biting off the twigs and gnawing the bark. The thoroughness with which they have been hunted has driven them into the most retired and thinly settled districts, and the time is not far distant when they will be extinct in all but the unsettled territories of the continent. In the curious order, Marsupiata, are included those animals, the young of which are brought forth prematurely, and received, in most instances, into a peculiar pouch situated on the lower part of the abdomen of the female. This order is represented in this country by the opossums, which are confined to the Southern, Western, and Middle States. The following account of the common American opossum as given by Goodrich, will suffice: It has a pointed head, wide gape, numerous sharp teeth, a rough tongue, ears large and naked, small eyes, the tail long, tapering, flexible and prehensile; the toes are armed with sharp, strong, curved claws. Its size is nearly that of a cat, but the form is low and squat; the color is a grayish-white; the face near the snout pure white; the ears black. In its habits it is mostly nocturnal and arboreal, feeding alike upon insects, eggs, small birds, and fruit. It sometimes invades the barn-yards and destroys the poultry, it is said, for their blood. It is a good deal hunted, and manifests much dexterity in escaping by creeping away amid the grass, and sometimes pretending to be dead. In defending itself it bites severely. It is sluggish in its movements, and will sometimes lie on its back for hours. It often suspends itself from the branch of a tree by its tail. It is very prolific, producing from six to fifteen at a birth. The young at this period are well-formed, and weigh from three to four grains each. As soon as produced they are shoved into the pouch by the mother with her snout, and pushed near the nipples, which they find and grasp by instinct. Their growth is very rapid; at a week old they weigh thirty grains. They remain in the pouch attached to the nipples till they are able to move about. In winter, if the climate is cold, they become sluggish, but not torpid like the woodchucks.

MAMMARY. Relating to the breast.

MAMMILLARY. In minerals, covered with rounded knobs like small teats.

MAMMITIS. (See Garget.)

MANDIBLE, MANDIBULA. In zoology, this term is applied to the lower jaw of mammals, and to both jaws of birds (except by Illiger, who restricts its application to the lower jaw in this class also.) In insects, it is applied to the upper or anterior pair of jaws.

MANDIBULATES, MANDIBULATA. The name of a section of insects, including all those which preserve their organs of mastication in their last or perfect state.

MANDREL. A revolving shank to which turners affix their work in the lathe.

MANEGE. The management of horses.

MANGANESE. A black mineral. Peroxide of manganese. The metal is gray, brittle, and hard. The protoxide of manganese forms numerous salts some of which are occasionally present in the ashes of plants.

MANGE. The cause of mange is the presence of a minute insect which live on, or burrows under the skin, various animals having their peculiar parasites. First wash the parts well with soap and water to break up and remove crusts or scabs; dry, and apply the following for the horse. Two pounds flowers of sulphur, and one pound quicklime, boiled with two gallons of water, stirring until the ingredients are fully combined. Bathe with this several times a day. Or, take two ounces each of tobacco and white hellebore; boil in three pints of water, strain, and when cold, add a pint of fresh lime water. Bathe with as heretofore directed. Scab, mange or itch in sheep, are caused by three different parasites. It is not prevalent in the United States. When sheep are found affected, make the following dip: One pound each of tobacco leaves and of sulphur, to each five gallons of water. Boil the tobacco in water until the strength is exhausted, and add the sulphur. Dip the sheep in this solution as hot as they can bear it, holding them in about four minutes, and occasionally thrusting the head under, being careful that it does not enter the nose and mouth. Repeat in a week if necessary. For mange in swine, scrub well with soft soap and warm water, and then after drying, rub with the following mixture: One pint of train oil and two drachms each of oil of tar, and oil of turpentine. To this add one drachm of petroleum, and mix with flowers of sulphur enough to make a thick paste. Rub on well and let it remain for three or four days, then wash off with strong suds of soft soap, change the bedding, and wash the floors and sides of the pen with soap suds in which has been dissolved a little carbolic acid, also give in the feed every day for ten days, one-half ounce flowers of sulphur and one drachm nitrate or potash.

MANGEL WURZEL. A variety of beet, producing heavy and sure crops in the West, where the turnip can not be successfully grown, and valuable as producing a succulent food adapted to the winter feeding of cattle and sheep. The yield may be stated at from fifteen to fifty tons per acre, according to richness of the soil and cultivation. On good corn land, sown in rows thirty inches apart, twenty-five tons per acre may easily be raised, costing for labor, including harvesting and pitting, not more than two dollars per ton. In the cultivation of any root crop, the soil should be brought into the finest possible tilth. If manure is used, plow it in deeply in the fall. In the spring, plow lightly when the soil is dry. Sow about four pounds per acre, and at the first weeding thin the plants to a distance of about six inches apart, if the rows are thirty inches apart. In cultivation, be careful not to break the leaves; since this will materially injure the crop. They must be gathered before the ground freezes, since they will not stand actual freezing. In pulling, lay them so the tops of two rows may point together, when they are quickly topped with a sharp spade. In pitting them, they should have ventilation until they undergo their sweat, and then covered so they will not actually freeze. Mangel wurzels are better if kept until the 1st of January before feeding, since they then loose an acrid principle they contain.

MANGER. A trough or crib in the stable, in which corn or cut provender for the horse is placed. The usual method is to have them the whole breadth of the stall; but this is unnecessary, as, if eighteen or twenty inches in length, and fourteen or sixteen in breadth, they will be sufficient for every useful purpose. In the fixing of them, they should be so contrived as to admit of being removed for the purpose of being cleaned. This could, however, never be done in the old method of fixing them, but by a little contrivance may be easily effected. It is, in many cases, a convenient plan to have them in the corners or angles at the heads of the stalls.

MANGO. It is a very large fruit tree, inhabiting the tropical parts of Asia, throughout all which it is as extensively cultivated as the apple in more temperate climates. Old specimens have been seen with a trunk from ten to fifteen feet in circumference. The fruit is something like a nectarine, but more compressed, longer, and more curved. It contains a large stone, covered with coarse fibers, which lose themselves in the succulent flesh. The wild and inferior varieties of this fruit taste so strongly of turpentine as to be wholly unfit for use by Europeans; but in the fine varieties this flavor is replaced by a rich sugary quality. The fruit of the *Mangifera indica*, is also called mango.

MANGOSTEEN. The fruit of the *Garcinia mangostana*, growing in Java and the Molucca Islands; it is of the size of an orange, and of a delicious flavor.

MANGROVE. Small trees of the genus *Rhizophora*, inhabiting the rivers and coasts of the tropical world.

MANHADEN. *Clupea manhaden.* A migratory fish, resembling the herring, taken in immense quantities off the eastern and northern coasts for manure; they should be made into a compost with earth or peat; some apply them naked to the land.

MANIOC. The Indian name of the starchy, nutritious matter obtained from the shrub *Jatropa manihot*, from which cassava and tapioca are made.

MANIPULATION. The operations of the laboratory.

MANITRUNK, MANITRUNCUS. The anterior segment of the trunk of insects, on which the head is placed.

MANNA. The concrete juice of the *Fraxinus ornus*, a species of ash growing in the south of Europe. The juice exudes spontaneously in warm, dry weather, and concretes into whitish tears; but the greater part of the manna of commerce is obtained by making incisions in the tree, and gathering the juice in baskets, where it forms irregular masses of a reddish or brownish color, often full of impurities. Manna consists of two parts: one a saccharine, crystallizable principle, named mannil, closely resembling sugar; the other is an acrid, uncrystallizable principle, which is the purgative agent in the manna.

MANTEL. In building, the wood, stone, etc., lying from one jamb to the other of the chimney.

MANTIS. A genus of orthopterous insects, with an exposed head, long and narrow body, and wings plaited longitudinally.

MANURE. Any substance which contains the elements of fertility, to the soil is manure. The composition and characteristics of various manures has come to be an important study wherever land has become so worn as to be infertile, and the best manner of sowing and applying to various crops, has attracted attention from the earliest times and in all countries. The ancients understood the value of manuring both, by plowing under green manure and the carting on of manure made by the feeding of animals. In modern agriculture, heavy manuring and thorough cultivation, is, the first the sheet anchor, and the second the cable which holds profitable agriculture safely. Manures may properly be divided into three classes: Barn-yard manure, either solid or liquid, commercial manures, and green crops plowed under. Barn-yard manure, is made of every waste substance about the farm, and is either applied, fresh or green, half rotted, in the form of compost, or as liquid manure, according to the nature of the soil, and the contingencies of the case. Where mechanical as well as chemical action is desirable, as on stiff soils, it is better that it be applied and plowed under fresh. For crops requiring its immediate effects, and especially to root crops, it should be given half rotted, or as compost. For special crops it is applied often in its liquid state. As to the question of sheltered as against unsheltered manure, the whole matter must be resolved by the question of cost of shelter, and the price of the products reaped. There is no doubt of the advantage of sheltering manure, if it be kept moist, from strong heating, and consequently from fire fanging. An experiment by Lord Kinnaird, of Scotland, will show this. The soil was a rich loam, lying on trap, and the field was planted in potatoes. One acre treated with sheltered manure yielded eleven tons, seventeen cwt., fifty-six pounds of potatoes, and another acre fertilized with like manure, twelve tons, twelve cwt., twenty-six pounds of potatoes; average of two acres, twelve tons, four cwt., ninety-seven pounds. One acre dressed with unsheltered manure yielded seven tons, six cwt., eight pounds of potatoes, and another, treated in like manner, yielded seven tons, eighteen cwt., ninety-nine pounds; average of two acres, seven tons, twelve cwt., fifty-three and one-half pounds. Gain in product of potatoes per acre, from application of sheltered manure, four tons, twelve cwt., forty-three and one-half pounds. A similar trial was made on wheat the next year. But the season was characterized by wet weather, and the grain was soft and not in very good order. Two acres dressed with unsheltered manure yielded, of wheat, weighing sixty-one and one-half pounds per bushel, respectively, forty-one bushels, nineteen pounds, and forty-two bushels, thirty-eight pounds. Two acres dressed with sheltered manure yielded, of wheat, weighing sixty-one pounds per bushel, respectively, fifty-five bushels, and five pounds, and, fifty-three bushels, forty-seven pounds. Average excess of product of wheat per acre, from the application of sheltered manure, twelve and one-third bushels of sixty pounds. Average of straw per acre from sheltered manure, 2.36 tons; from unsheltered manure, 1.72 tons, showing an excess of .64 ton from the former application. Some persons suppose that sheltered manure gains nitrogen from the air. This, however, is not true. In recent experiments by M. Boussingault on the nitrification of a vegetable mold in confined, unrenewed, stagnant air, it was shown that under such conditions the nitrogen of the atmosphere takes no part in the nitrification, which is accomplished with loss of nitrogenous organic matter. The composition of manure is an important subject. It is now generally admitted, what has long been known to intelligent investigators, that the value of manure depends upon the food of the animal. Prof. Goessman, of Massachusetts, states the following, partly made up from German experiments: Some of the material is the fruit of recent German experiments. At a temperature of 100° centigrade, the dry substance of the entire fresh solid and liquid excretions of cattle, sheep, and horses amounts, on an average, to fifty per cent. in weight of the dry substance of the food consumed. Prof. Wolff thus states the percentage of the dry substance of the food of cattle found in the excrements:

There were found	Cows.	Oxen.	Sheep.	Horses.	Aver'ge
In the urine....	9.1	5.8	6.6	3.6	....
In the fæces ...	38.0	45.4	46.9	42.0	... .
Total	47.1	51.2	53.5	45.6	49.4

On an average, the weight of dry straw required for absorption reaches one-quarter of the weight of the dry substance consumed as food. Putting the composition of stable manure as twenty-five parts dry substance and seventy-five parts water in 100, it follows that for every 100 pounds of dry-food substance consumed 300 pounds of stable manure will be produced. Placing the daily amount of dry fodder consumed at twenty-four pounds for 1,000 pounds of live weight of the animal, and allowing six pounds of straw for bedding, the product of manure, in stable feeding, of an animal of the stated weight, will amount to seventy-two pounds daily, or 26,280 pounds per year. But considerable variation exists between the different classes of animals as regards the amount of straw required for bedding; the daily requirement of wheat straw being estimated at six pounds for a horse, eight pounds for a cow, four pounds for a pig, and 0.6 pound for a sheep. In general farming, if the farm-stock has been well fed, 1,000 pounds of the manure will contain 4.5 pounds to 5.8 pounds of nitrogen. The commercial value of stable manure may be approximately represented by allowing for every ton of manure ten pounds of potassa, eight pounds of nitrogen, and four pounds of phosphoric acid. On account of the highly beneficial action of stable manure on the physical condition of the soil, its agricultural value, as a rule, stands higher than that of any commercial artificial fertilizer giving the same proportions of the named constituents. But a good concentrated fertilizer may, under certain circumstances, be a valuable assistant of stable manure. It has been customary on large estates to calculate the nitrogen afforded by the excretions of the entire number of farm animals at seventy-five per cent. of the nitrogen of the food consumed, allowing twenty-five per cent. for nitrogen carried off in milk, animal texture, etc. Taking cows and oxen, which require 6.5 ounces to seven ounces of nitrogen in their daily food for each 1,000 pounds of live weight, their annual consumption of nitrogen per 1,000 pounds of live weight would range from 148 pounds to 171 pounds. A deduction of twenty-five per cent. being made, there would remain in the fresh excrement 111 pounds to 128 pounds of nitrogen; as much as would be found in 750 to 800 pounds of best Chincha Island guano, or in 3,200 pounds of bone meal, or in 25,000 pounds of half-rotted barn-yard manure. But the efficiency of the excrements depends greatly on the preservation of the entire amount of liquids and solids. The following table, from Prof. Wolff, shows the proportion in which the nitrogen of the food is distributed in the animal excretions. The figures exhibit the number of parts for 100 parts of nitrogen contained in the food:

Amonnt found in food.	Cows	Oxen.	Sheep.	Horses.	Aver'ge
Nitrogen in solid excretions.....	45.5	51.0	43.7	56.1	49.1
Nitrogen in liquid excretions	18.3	38.0	51.8	27.3	33.9

But the excretions of high-fed oxen often contain two and a half times as much nitrogen, and three and a half times as much phosphoric acid as those of cows or young cattle, whose milk or growth carries off a large amount of the named elements. We now come to compost. A compost of barn-yard manure, is simply whatever may be collected about the farm, piled together in a compact heap, kept moist, and turned over often enough to keep it from heating strongly enough to discharge its gases, and used when it decomposes into a homogeneous mass. To facilitate this it may be mixed with swamp muck, old sods or whatever earthy material may be procured. Neither ashes nor lime should be mixed with fresh manure; but ashes at the rate of four or five bushels to each load of peat or swamp-muck, makes an excellent compost for special crops, as potatoes or other root crops. As a special fertilizer, compost acts immediately and hence its value for any drill, hill crops, or garden vegetables. As to the changes which take place in barn-yard and other manurial substances in the process of decomposition, the laborious experiments of Dr. Voelcker, made upon large quantities of manure, treated in various manners, for the purpose of noting results from careful analyses from time to time are interesting. It was shown that the great loss occurring to barnyard manure in the process of rotting is not the escape of ammonia into the air, for it was found that this was light, but the principal loss is in the washing out of the soluble portions by the rain. In the climate of England where evaporation is slow, and rain falls often, this would take place to a greater extent than here, since we must use means to keep it moist enough during summer while in England, they have to guard against leaching. The idea is to keep the whole mass moist, but not dripping. The following table gives the composition in pounds of an experimental heap of manure at four different periods, showing the changes that occurred:

	Nov. 3.	Apr. 30.	Aug. 23.	Nov. 15.
Weight of manure in lbs.	2,838	2,026	1,994	1,974
Water	1877.9	1336.1	1505.3	1466.5
Dry matter	960.1	689.9	488.7	507.5
Soluble organic matters	70.38	86.51	58.83	54.04
Soluble inorganic matters	43.71	57.88	39.16	36.89
Insoluble organic matters	731.07	389.74	243.22	214.93
Insoluble inorganic matters	114.94	155.77	147.49	201.65
	960.1	689.9	488.7	507.5
Total nitrogen	18.23	18.14	13.14	13.03
Equal to ammonia	22.14	22.02	15.96	15.75

It is to be observed that during the first six months, although the weight of the manure largely diminished, the loss was almost exclusively confined to the insoluble organic matters; while soluble matters had increased, and the ammonia remained undiminished. But during the hot summer weather all the most valuable matters had undergone diminution. The conclusions to which they lead are these: Farm-yard manure, in its fresh state, contains but a small quantity of ammonia, most of its nitrogen being there as insoluble nitrogenous matters. But as the decomposition advances the ammonia increases, and a quantity of organic matter becomes soluble. For this reason the manure should be preserved in such a manner as to prevent the escape of the soluble portions which are the most valuable. This can be effected by keeping it in water tight pits, or under cover; but in the latter case the manure, particularly if it contain a large proportion of litter, is not sufficiently moist to admit of its ready fermentation, and water must be added in sufficient quantity to promote that change. The worst of all modes of keeping manure is to pile it in heaps in the corners of the fields, for under such circumstances it is most liable to loss; and if the manure must be carted out, it is better to spread it upon the soil at once, because when this is done fermentation is stopped; and as there is very little free ammonia the loss is small, and the soluble matters are uniformly washed into the soil by the rain. Dr Voelcker is of opinion that the most advantageous mode of applying the manure would be in all cases to leave it on the surface to be washed into the soil, by which means its distribution is more uniform than if it be plowed in. The most disadvantageous mode of making manure is to produce it by cattle in open yards, for in this way at least two-thirds of the valuable matters are lost after a year's exposure. Liquid manures are the soluble portions of any substance containing plant food in combination with water. Thus, the drainings of the barn yard into any depression that becomes puddled so as to retain water, is liquid manure, but the proper way to obtain it is to prepare a tank into which it may leach without waste. Dr. Voelcker, made extensive experiments on the changes which liquid manure undergoes in soils of known composition. The following were the conclusions arrived at:

Liquid manure, in contact with soil, undergoes a number of chemical changes.

These changes are greater in the case of clay and calcareous soils, than in the case of sandy soils.

Passed through clay, loamy, and calcareous soils, liquid manure leaves a considerable quantity of ammonia in the soil.

Under the same circumstances, liquid manure parts likewise with potash and phosphoric acid.

Sandy soils remove from liquid manure but little ammonia, and likewise not much potash.

With the exception of purely sandy soils, liquid manure, as used in practice, leaves the greater portion of all the most valuable fertilizing matters in the generality of soils.

The comparative power of different soils to remove ammonia, potash, and phosphoric acid from liquid manure, differs greatly.

Liquid manure passed through sandy soils rich in soluble silica takes up soluble silica.

Soils that absorbed much ammonia also absorbed much potash, and the soils which absorbed little ammonia also absorbed little potash.

Soda salts (common salt) are either not at all removed by liquid manure, or only to a small extent.

Chlorine, and generally sulphuric acid, remain unaltered in quantity in liquid manure passed through different soils.

In most cases liquid manure left in contact with different soils becomes richer in lime.

The proportion of lime which liquid manure takes up from the soils with which it is brought in contact does not altogether correspond with the relative proportions of lime in the different soils.

Liquid manure passed through a sandy soil greatly deficient in lime became poorer in lime; thus showing that the property of soils, of storing up food for plants, is not confined to ammonia, potash, or phosphoric acid, but that it is a property which manifests itself in a variety of ways. Thus soils rich in lime yield this substance to liquid manure. Again, potash usually is removed from liquid manure left in contact with soils; but in particular cases liquid manure may even become richer in potash after filtration through soil.

Very soluble saline fertilizing compounds are probably injurious to vegetation when applied too abundantly to the land.

All moderately fertile soils have the power of rendering the more important soluble fertilizing matters much less soluble; but in none of the experiments were ammonia, potash, phosphoric acid and other compounds that enter into the composition of the ashes of our cultivated crops, rendered perfectly insoluble.

It does not appear probable that plants take up mineral food from the soil in the shape of totally insoluble combinations.

In surface manuring, not always practicable, but when so, always effective and economical, since fresh manure may be used, as in the case of fallows, meadows, pastures, orchards, etc., we save the elements of strength in the manure and really get the benefits of liquid manuring. In relation to this matter, Mr. Bright, a well known horticulturist, and writing on manuring from a horticultural stand point, says: The practice of top-dressing, or of surface-manuring, has long been the favorite method employed by all intelligent gardeners within the circle of my acquaintance. We have long ago learned that masses of rich, nitrogenous manures are not what plants require about their roots, but that manures are applied much more successfully (and less injuriously) by top-dressing, either in solid or liquid form. Nature never manures her plants with crude masses of concentrated fertilizing substances, but imparts her stimulating and mineral food in a state of the most minute division—almost infinitesimal—chiefly from the surface of the earth. No wonder so many fruit trees have been killed, so many grape vines destroyed or rendered barren by excess of wood, in consequence of the heavy manuring at the roots so universally recommended by writers on gardening and horticulture. The great objection to surface-manuring is founded upon the probable loss of ammonia, caused by the exposure of decaying manures upon the surface of the earth. But this loss has been shown, by sound reasoning, and by facts deduced from practical experience, to be much less than is commonly apprehended; while the benefits arising from surface-manuring in other respects, more than counterbalance any possible loss of ammonia from this practice. In the first place, when manures are exposed upon the surface of the earth, even in hot weather, decomposition no longer goes on so rapidly as when the same manures are kept in a heap, and the ammonia that is produced is gradually carried into the soil by rains. The other soluble substances, as potash, lime, the phosphates, etc., are of course not lost, because they are not volatile. Nor are these soluble and valuable substances lost to plants by being carried into the soil before they are needed by growing plants. It has been conclusively shown by eminent scientific authorities that any good soil, containing a fair proportion of clay and carbon, is capable of taking up and retaining effectually ammonia, lime, potash, soda, etc., in a soluble form, so that little, if any, passes off in the under-drainage water of such soils. These substances, it is true, may wash from the surface, but they can not pass through a good soil and go off in the drainage water. By surface-manuring we mulch the ground, and render it cooler in summer and warmer in winter. More shade is an important element in culture—so important that some writers have thought shade alone to be equivalent to manure. A piece of soil heavily shaded by surface-manuring actually decomposes like a manure heap—that is, it undergoes a sort of putrefaction or chemical change, which sets free its chemical constituents, unlocks, as it were, its locked-up manurial treasures, and fits its natural elements to become the food of plants. Darkness, moisture and air are the conditions required for vegetable and mineral decomposition, for under these conditions decay is quick. These conditions are produced in the soil by surface-manuring. Then, again, when the surface-manure decomposes, its elements are washed into the soil in a state of solution precisely fitted to meet the wants of plants, and they become active agents in promoting further decomposition and chemical changes in the body of the soil. Manure, then, chiefly upon the surface. Do not waste your manures by mixing them deeply with the soil. Plant shallow. Keep roots of all trees, plants, and vines as near the surface as possible. There are weighty reasons for the position assumed in preceding sentence, says our authority, and he reiterates most forcibly, plant then shallow. Let your soil be deep and dry, but plant near the surface as much as possible. Top-dress your grass, after mowing in July or August, under a burning summer sun; top-dress in the fall, before and during the autumn rains; manure the surface while snow is on the ground, while the March winds blow, and while the April rains fall. Manure your grass, instead of your corn and wheat, broadcast at any time when you have manure and leisure, and you will be abundantly satisfied with the result. In the application of farm-yard manures, critically carried out in the United States, there have been but comparatively few well digested experiments. In Europe the case is different. There they have experimented largely and with barnyard and commercial manures. The Superintendent of the Kansas Agricultural College farm made the following experiment, to determine the value of green manure both, as against yield on poor land with manure and as against yield upon naturally rich soil, and also, as between manure and no manure on homogeneous and fertile soil with the following results, illustrating its decisive value even on the more fertile of western soils: One half of field No. 7 of the Kansas State Agricultural College farm is a badly washed hill-side, washed to the underlying red and yellow clay. The other half of the field is second bottom; the soil a deep alluvium, rich and black. A sharper contrast in one field could hardly be imagined. This contrast furnished an opportunity for testing the relative merits of manure, an opportunity that was gladly improved. Early in May the clay hill-side was dressed with green stable manure, at about the rate of thirty tons per acre, which was immediately plowed under to the depth of five or six inches, the nature of the soil not permitting a deeper furrow. Even at this shallow depth the soil rolled up after the plow in hard, sticky masses, upon which harrow and roller had but little effect. Many who saw the field at this time expressed the opinion that the hill-side would not produce even corn nubbins. After plowing, the clay hill-side was top-dressed with a compost of rotted manure, ashes, and old mortar, at the rate of fifteen two-horse loads per acre, after which the whole surface was repeatedly harrowed and rolled. As soon as this was finished the whole field, the lower half having been plowed to the depth of eight inches and thoroughly harrowed in the mean time, was marked off and planted with corn, the Milton or Mammoth Dent. No manure was used upon the lower part of the field. Both parts were cultivated alike. The land was new, this being the second crop from the sod. The crop was harvested the last of November, and returned forty-five bushels per acre from the lower land and sixty-five bushels per acre from the manured clay hill-side, an advance of forty-five per centum in favor of the washed hill-side, and attributable alone to the effect of the manure. In the earlier part of the season this field was frequently trespassed upon by cattle, and probably one-third of the crop was thus destroyed. As the two parts of the field suffered alike, the result pro rata is the same, and we have in contrast the poorest and best of our Kansas soils. The poorer, treated with manure at the cost of $11 per acre, exceeding by forty-five per centum the yield of the better soil without manure. It would be difficult to more strongly illustrate the effect of home-made fertilizers upon Kansas clays. The contrast in this single instance, however, may be too well defined for general application. Fields Nos. 5 and 6 of the College farm present no such contrast, being identical in soil and situation, the division being entirely arbitrary, and only indicated by a narrow drive. These two fields are a fair representation of prairie loam, conforming essentially to the soil of the second bottom of field No. 7. Field No. 5 received an application of green stable-manure, at the rate of forty tons per acre. No. 6 received no manure. Cultivation essentially the same. Result: the yield of sound corn upon field No. 5 was 100.1 bushels per acre, as ascertained by actual measurement by a committee of disinterested persons. The return from No. 6 was between sixty and sixty-five bushels per acre, or an increase of fifty-eight and one-third to sixty-six and two-thirds per centum per acre, due solely to the use of manure. At the Michigan Agricultural College the following results were obtained: One acre of very light sandy soil was selected from a clover field, the second year from seeding and mowed once in 1867. This acre was equally divided into sixteen plots, and manures were applied to every alternate plot, as follows: The two composts of muck and ashes, and the two of muck and lime, having been carefully mixed, under shelter, in February 1868, and shoveled over from time to time, till properly incorporated. On plot 1, one load of muck and leached ashes, mixed in the proportion of five loads of muck to two loads of ashes; on plot 3, one load of muck mixed with quicklime slaked with water, in the proportion of five loads of muck to ten bushels of lime; on plot 5, one load of muck and quicklime slaked with a saturated solution of common salt, in the proportion of five loads of muck to ten bushels of lime; on plot 7, one load of muck and wood ashes, in the proportion of five loads of muck to one load of ashes; on plot 9, one load of muck; on plot 11, one-half bushel of ashes and one-eighth bushel of gypsum; on plot 13, one-half bushel of ashes; on plot 15, one-eighth bushel of gypsum. The following table exhibits results in pounds:

Lots.	Manures applied.	First crop.	Second crop.	Total.	Gain.	Gain per acre.
1	Muck and leached ashes.....	265	149	414	118	1,856
2	No manure.....	200	98	298	....	....
3	Muck and lime slaked with water.......	200	78	278	47	752
4	No manure.....	125	39	164	....	....
5	Muck and Lime slaked with brine.........	128	30	158	Loss 11	Loss 176
6	No manure.....	134	40	174	....	....
7	Muck and ashes	204	90	294	72	1,152
8	No manure.....	188	82	270	....	....
9	Muck	224	102	326	46	736
10	No manure.....	211	89	300	....	....
11	Ashes and Gypsum	204	67	271	23	368
12	No manure.....	154	43	197	....	....
13	Ashes	169	49	218	15	240
14	No manure.....	164	45	210	....	....
15	Gypsum..	218	92	310	88	1,408
15	No manure.....	190	45	235	....	....

According to this exhibit, the total products of the unmanured plots, respectively considered, ranged from one and one-sixth ton to two and one-seventh tons of hay, reckoning 2,240 pounds to the ton. It will be seen, by reference to the widely-ranging products of the unmanured plots, that the soil was, in the first place, quite unequal in productiveness. Caution is, therefore, required in drawing conclusions from these results. The statement of gain arising from each applied manure is estimated by comparison with the yield of adjoining unmanured plots. The prominent points of the exhibit are these: The muck and leached ashes, the gypsum, and the muck

	Description of Manures.	Per cent. of ammonia, (nitrogen equivalent to —)	Amount of manure per acre.	Price of manure per ton.	Grain per acre.	Weight per bushel.	Value of grain per acre.	Total value of grain, straw, and chaff, per acre.	Net profit of manured over unmanured.	Loss.
	Experiments on wheat.		Tons.	£ s. d.	Bush.	Lbs	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1	Dung from open cattle yard..........	.60	11 2-3	0 6 0	31	59	10 15 2	14 1 2	1 3 0½	....
2	Dung from covered cattle yard......	.77	11 2-3	0 5 0	35	59	11 14 7	14 8 11½	1 10 10	....
3	Shoddy, (factory waste manipulated)	7.72	1 1-6	3 0 0	34 3-4	50	11 19 11½	15 0 4	2 2 2½	....
9	Peruvian guano....	10.96	7-27	13 10 0	31 1-2	60	11 0 0	13 3 6	0 5 4½	.. ....
10	Unmanured	....	....	....	22 1-2	59	7 12 6	9 8 1½	....	....
11	Sulphate of ammonia..................	24.50	7-40	20 0 0	38 1-2	61	13 7 5	16 4 9½	3 5 8	....
12	Nitrate of soda, (applied in autumn).	19.50	7-37	18 10 0	32	60	11 1 2	13 1 8	0 3 8½	....
13	Ground rape cake.........	5.08	1-2	7 0 0	31 3-4	60	10 19 5½	13 0 4	0 2 2½	....
14	Superphosphate of lime.	....	7-10	5 0 0	25 1-2	59	8 10 1¾	10 0 10¾	....	2 17 2¾
15	" "	....	7-9	4 10 0	25 2-3	60	9 4 8	10 19 11	....	1 18 2½
16	Patent ammonia.......................	14.90	7-24	12 0 0	38 1-2	60	13 4 5	16 2 2	3 4 0½	... .
17	Nitrate of soda, (applied in spring).	19.60	7-37	18 10 0	39 1-5	59	13 6 1	16 9 5½	3 11 4	....
	Experiments on barley.									
18	Dung from open cattle yard..........	.46	11 2-3	0 6 0	38 1-4	54	9 11 3	11 5 6	....	1 19 8
19	Dung from covered cattle yard.......	.77	11 2-3	0 6 0	43 1-4	54	10 18 2	12 15 2	....	0 11 0
22	Unmanured	....	....	....	37 1-2	52	9 4 2	11 6 2	. ...	... .
23	Nitrate of soda	19.50	7-37	18 10 0	48 2.3	53	12 7 10½	15 1 1½	1 14 11½	....

and wood ashes gave the largest products; the ashes and gypsum were less effective than the gypsum alone; a loss resulted from the applied mixture of muck and lime slaked with brine. The following results will be interesting as showing experiments in England with manures of various kinds, both domestic and commercial: The first is a selection from a report of experiments made by Messrs. H. F. and A. Harwood, of Ipswich, England, in 1872, on light land which had been cropped in 1870 with wheat, manured with ten tons of farm-yard dung per acre, and in 1871 with barley, manured with five cwt. of mixed artificial manures per acre. This barley crop having been removed, equal plots were measured off, various manures applied; at a cost of £3 10s. per acre, in each case, and wheat sown. Other plots were marked off for barley. The table, on page 627 gives the descriptions of manures and the quantities applied per acre, and the results obtained. The superphosphate received by wheat plots 14 and 15 contained, respectively, twenty-eight per cent. and seventeen per cent. of soluble phosphates. In addition to the merchantable grain represented in the column of yield, there was a small amount of refuse grain, the value of which is included in the statements of total values of the crops. Applications of this exhibit to American practice will, of course, be modified by prices of manures and values of grain and straw in different localities. English experimentalists have found that in general not one-half of the nitrogen of such manures as guano, ammonia salts, and nitrate of soda, is recovered in the increase of the crop to which they are applied. As to the residue, a portion may remain comparatively inactive in the soil, and a considerable portion may, under conditions favorable to drainage, be carried away and lost. With a view to these points, experiments were commenced at Rothamsted, England, in 1871, to determine whether any economical advantage can be gained by applying such manures in comparatively small quantities near the seed, instead of larger amounts broadcast and harrowed in. In the following tabulated experiment with wheat, the plots measured one-quarter of an acre each, and the amount of seed in each case was one bushel per acre. The fertilizers in this and the barley experiment were intimately mixed with ashes of burned clay before application. The 146 pounds sulphate of ammonia applied on plot two contained nitrogen equal to that contained in fifteen bushels of wheat, with straw in proportion, and the imperfect recovery of the nitrogen is indicated by the fact that the yield on this plot was only seven and three-fourths bushels per acre in excess of that of the unmanured plot. That the soil can not be expected to return any large additional percentage of the nitrogen in seasons subsequent to that of the application has been already shown by experiments at Rothamsted. In his report for 1864, Mr. Lawes says that the unexhausted residue of nitrogen supplied in ammonia salts was but very partially and very slowly recovered in increase of crop in succeeding years, even with liberal applications of such mineral manures as were very effective to crops when used in conjunction with newly applied ammonia salts. The subjoined is a tabulation of experiments on barley. The plots were one-half of an acre each; amount of seed, three bushels per acre, except on plot five, which received one and a half bushels of seed per acre.

Plots.	Manurea per acre, etc.	Wheat per acre.	Weight per bushel.	Straw per acre.
		Bush.	Lbs.	Cwt.
1	Unmanured(seed dibbled six inches apart in the rows)...............	23¾	59.3	24½
2	146 pounds sulphate ammonia(holes dibbled six inches apart, in rows,) manure put in, and seed above...	31½	59.1	36¼
3	292 pounds sulphate ammonia, (broadcast, seed dibbled six inches apart in rows)..............	28¾	58.3	35⅝

Plots.	Manurea per acre, etc.	Barley per acre.	Weight per bushel.	Straw per acre.
		Bush.	Lbs.	Cwt.
1	Unmanured; seed drilled..........	40½	53.9	24⅝
2	100 pounds superphosphate; 100 pounds nitrate soda; manure broadcast; seed drilled..........	49⅞	53.3	30½
3	100 pounds superphosphate; 100 pounds nitrate soda; manures drilled; seed above..............	49½	53.4	28½
4	100 pounds superphosphate; 100 pounds nitrate soda; manures (with clay-ashes as usual) and seed mixed and drilled together.	51	53.0	30⅜
5	100 pounds superphosphate; 100 pounds nitrate soda; holes dibbled six inches apart, in rows; manures put in, and seed above.	51¼	53.3	28¼
6	200 pounds superphosphate; 200 pounds nitrate soda; manures broadcast; seed drilled..........	56¼	51.6	32⅞

The following is a summary of the experimental statement of Mr. J. B. Lawes on the effect of different fertilizers on oats grown on the same land during the three years from 1869 to 1871, inclusive, at Rothamsted, England: The previous croppings were 1847 and 1848, clover dressed with different manures; 1849 to 1859, beans with different manures; 1860, fallow; 1861 and 1862, wheat, unmanured; 1863, fallow; 1864, beans, dunged, 1865, wheat, unmanured; 1866, beans, unmanured; 1867 and 1868, wheat, unmanured. The area of the experiment was three-quarters of an acre, which was divided into six plots. As to applications per acre, plot one was not manured; plot two received 200 pounds sulphate of potash, 100 pounds sulphate of soda, 100 pounds sulphate of magnesia, and three and one-half cwt. superposphate of lime made from 200 pounds bone-ash, 150 pounds sulphuric acid of 1.7 specific gravity, and water; plot three received 400 pounds ammonia salts, composed of sulphate and muriate of ammonia of commerce in equal parts; plot four received 400 pounds ammonia salts, 200 pounds sulphate of potash, 100 pounds sulphate of soda, 100 pounds sulphate of magnesia, three and one-half cwt. superphosphate; plot five received 550 pounds nitrate of soda, (containing the same amount of nitrogen as 400 pounds ammonia salts;) plot six received 550 pounds nitrate of soda, 200 pounds sulphate of potash, 100 pounds sulphate of soda, 100 pounds sulphate of magnesia, three and one-half cwt. superphosphate. The table page 629 gives results

Plots.	1869.			1870.			1871.			Average for three years.		
	Oats per acre—bushels.	Weight per bushel—pounds.	Straw per acre—cwt.	Oats per acre—bushels.	Weight per bushel—pounds.	Straw per acre—cwt.	Oats per acre—bushels.	Weight per bushel—pounds.	Straw per acre—cwt.	Oats per acre—bushels.	Weight per bushel—pounds.	Straw per acre—cwt.
1....................	36⅝	36¾	19¼	16⅜	35	9⅛	20½	33½	11¼	24½	35	10⅞
2....................	45	38½	24½	19⅛	35⅛	9⅝	22	35¼	13½	28¾	36¼	15⅞
3....................	56⅛	37½	36⅞	30	34⅞	17¼	57⅛	35⅜	40⅝	47¾	36¼	31⅝
4....................	75¼	39¼	54	50⅝	36	28⅝	58⅝	35⅜	50	61½	36⅞	44¼
5....................	62¼	38⅛	42¾	36½	35¼	23	55	36⅝	34¾	51¼	36¾	33½
6....................	69⅜	38½	49⅞	50	35¾	28¾	60¼	33¾	48⅛	59⅞	36	42½

The following is an abstract of a report of private experiments made in Scotland: The soil was a good clay loam of very even quality, in very moderate agricultural condition, the subsoil a light sandy loam. The field was divided into sixteen plots of one-eighth of an acre each. Furrows were laid out twenty-seven inches apart, the manures were placed in the bottom of these furrows, and potatoes of the regent variety were dropped thereon, ten inches apart, May 1, 1871; the potatoes were then covered by running the plow through the ridge made between the furrows and throwing back the earth, according to the current practice of the region. The after cultivation consisted of hand and horse hoeing, and finally earthing up. The potatoes were dug November 2; were sorted over a one and five-eighths inch riddle and the large and small were separately weighed and pitted. At this time no diseased tubers were observed. On the 15th of March they were taken from the pits, the diseased tubers thrown out and the sound ones weighed. The diseased tubers amounted to about one-third of the whole crop, the proportion not varying greatly between the different plots, but being somewhat greater in the plots which received dung than in those which received artificial manure alone. The table shows the manures applied and the results obtained per acre, and given substantially in the order of largest yield, as it occurred. The left hand column indicates the relative locality of each plot. The sulphate of ammonia contained twenty-four per cent. of ammonia; the dissolved coprolites, twenty-six per cent. of soluble and five per cent. of insoluble phosphate; and the kainit, or potash salt, twenty-four per cent. of sulphate of potash. As to the sources of manure it is stated as follows: Carbonaceous matter is derived from the natural decay or chemical decomposition of vegetables. Vegetables collected into masses, as leaves, wood, grasses, straw, the stalks and stems of all plants, fruits, grains, roots, etc., under favorable conditions of temperature and moisture, rapidly undergo, first, the fermentation; and, secondly, the putrefaction process. Where there is too much or too little heat, or too much or too little moisture, fermentation will not go on. The fibers of vegetables thus collected in masses, under favorable circumstances, soften and swell, and become permeable to air and water. Their salts, starch, gum sugar, gluten, and extractive matter are dissolved, their carbon combines with oxygen, and carbonic acid is

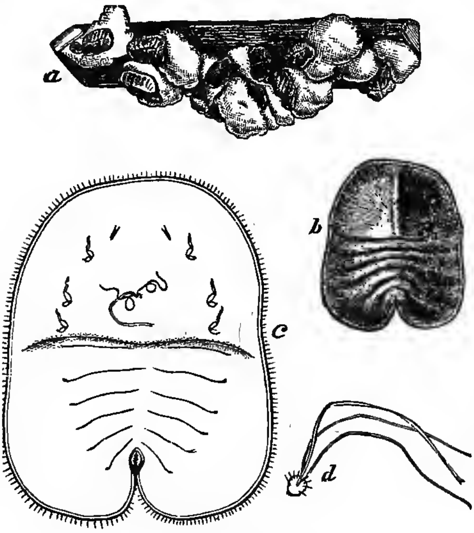
Plots.	Manure per acre.	Large potatoes per acre.				Total of large and small potatoes per acre.			
		Tons.	Hundred-weight.	Quarters.	Pounds.	Tons.	Hundred-weight.	Quarters.	Pounds.
5	400 pounds sulphate of ammonia, 400 pounds dissolved coprolites..	9	19	0	8	12	3	1	12
4	200 pounds sulphate ammonia, 400 pounds dissolved coprolites, 200 pounds kainit	7	15	1	12	10	0	0	8
9	200 pounds sulphate ammonia, 400 pounds dissolved coprolites..	7	7	2	8	9	9	0	16
16	16 loads dung, 200 pounds sulphate ammonia, 300 pounds dissolved coprolites, 200 pounds kainit..................	7	9	1	4	9	6	0	16
1	Ditto..	7	4	3	12	9	5	3	20
10	400 pounds sulphate of ammonia............................	7	2	2	0	8	18	3	4
8	400 pounds sulphate ammonia, 400 pounds kainit...........	6	6	2	24	7	18	0	16
15	16 loads dung..	5	6	2	16	6	14	1	20
2	Ditto..	5	5	3	12	6	11	2	8
6	400 pounds dissolved coprolites, 400 pounds kainit..........	4	18	0	8	6	6	2	16
13	400 pounds kainit	4	0	1	12	5	5	3	12
14	No manure.....	4	0	3	4	5	4	2	16
7	Ditto..	3	19	2	24	5	4	2	0
3	Ditto..	3	18	1	12	5	0	2	24
11	Ditto..	3	15	0	0	5	3	3	20
12	400 pounds dissolved coprolites..............................	3	16	1	4	5	6	2	16

formed and penetrates the whole mass. This acid combines with the alkalies that are present, as potash, lime, soda, magnesia, and ammonia, and carbonates of potash, lime, etc., are formed. Certain elements in the mass soon take on the action of putrefaction. This process is owing chiefly to the presence of elements containing nitrogen, as gluten and other matters of animal origin. All animal substances pass rapidly into the process of putrefaction, and the larger the proportion of such substances mingled with the vegetable masses, the more rapidly putrefaction proceeds. Hence the addition of animal manures to vegetable composts facilitates putrefaction. By the process of putrefaction hydrogen also is rapidly developed, and combines with phosphorus and sulphur when these are present, forming sulphuretted and phosphoretted hydrogen. When the surfaces of these putrefying masses are exposed freely to the atmosphere, these gases, which are very volatile, are rapidly dissipated. To prevent this, substances should be applied which have the power of absorbing and retaining them. Carbon, when nearly pure and dry, has a strong affinity for them. The addition of dry charcoal, or of peat, will absorb large quantities of them. When these gases are thus absorbed their presence ceases to be indicated by their peculiar odors. The sulphates of lime, iron, and zinc have a similar power, hence their value as deodorizers. These sulphates have also the power of decomposing carbonate of ammonia, displacing the carbonic acid, and forming sulphate of ammonia, which is not volatile. Chloric and nitric acids will also decompose carbonate of ammonia, forming with it chlorates and nitrates of ammonia, which are soluble in water, as are also salts which they form with the other alkalies. Vegetable compost, then, when the decomposition is complete, consists chiefly of carbonaceous matter combined with gases and salts. By a process in many respects similar to that above described, vegetable substances are decomposed in the digestive organs of animals. The fibers are comminuted by the teeth, and fitted to be pervaded and softened by the fluids contained in the stomach and intestines. A large portion of the starch, gum, sugar, gluten, and salts is dissolved out, and taken up by the lacteal vessels of the animal, and serve the purposes of nutrition, while the remainder, mixed with the juices of the animal, containing various salts, is ejected. This process is accomplished much more rapidly than the ordinary process of vegetable decay, and the substance resulting is mixed with a large amount of animal matter, which fits it for rapid putrefaction. When the necessary conditions are present, this animal matter, which pervades the mass like leaven, sets up the process of putrefaction at once. These two processes, vegetable composting and the feeding of animals with vegetables, are the sources from which carbonaceous manures are chiefly derived. Vegetables reduced by the process of digestion, although they have parted with a large portion of their nutritive elements, yet, in consequence of the condition to which they are brought, and the additions which they have received, are more valuable as manures than when, without serving the purposes of nutrition, they are reduced by the ordinary process of decay. But the slow decomposition of vegetables is always going on in nature, and thus one generation of plants affords nutriment to those that come after it. The carbonaceous matter resulting from the decay of vegetables is not all taken up as it is formed. Masses of it have accumulated in swamps, basins, and meadows. These accumulations, mingled with more or less of insoluble earths constitute muck or peat, and furnish an almost unlimited amount of carbonaceous material fitted for the immediate use of the cultivator. The difference which is found in different accumulations of this material is owing in part to the difference in the vegetables from which it has been formed, and in part to the difference of the soils upon which it rests and by which it is surrounded. In some deposits the matter is almost purely carbonaceous; in some the composition is complete; in others but partial. But the most essential difference in different deposits of muck is, that some contain acids, or acids combined with minerals, while others are nearly or quite free from them. These acids are the carbonic, humic, crenic, and apocrenic. When deposits of muck are underlaid by clay, or receive the wash of clay beds in their vicinity, and iron is present, which it often is in the form of bog ore, the sulphate of alumina, which is the basis of clay, is decomposed, and the sulphuric acid combines with the iron and forms sulphuret of iron, or pyrites, which is often found in muck in sufficient quantity to impair its value as a fertilizer. When any of these acids abound in muck it is unfit to be used in a simple state. Alkalies are the proper correctives, and of these lime seems to be the best adapted to remedy the evil. Quicklime, mixed with peat, has the effect of rapidly rendering it pulverulent and light. Its influence seems to extend through the whole mass, like that of yeast through the whole mass of dough, while at the same time it combines with the acids and decomposes the salts of iron, forming salts of lime, which themselves are essential to the growth of many plants. Muck, when free or nearly free from acids, may be used by itself with great benefit on light, sandy soils, or on any soils from which the vegetable matter is exhausted; or it may be composted with stable manure, ashes, guano, or animal matters, with peculiar advantage, since it has, as we have already observed, the power of absorbing and condensing the gases arising from the putrefaction of these substances. Such composts are adapted to nearly all the uses of the garden and field. No substance is so well adapted to composting with night soil and urine as dry muck, since it deodorizes these manures and retains all their valuable elements, and renders them manageable and easy of application, affording at the same time the dilution which is necessary for the safe application of concentrated manures. Composted with putrefying fish, muck forms an exceedingly valuable manure. The best mode of preparing muck for use is to throw it from its bed in the autumn, and leave it exposed to the action of the frosts of the succeeding winter. If it is to be composted with lime or ashes it may be used the following spring. But if it is to be composted with stable manure, night soil, or animal matters, it is better to let it remain in the heap until the following autumn, when it should be deposited in the barn-yard or cellar, and mixed, from time to time, with the drippings of the animals It is evident that it should be provided in sufficient quantity to be used freely as a deodorizer about the premises whenever or wherever it may be wanted. It will thus become charged with gases and salts, and be converted into a highly valuable manure, which for a garden and for fruit culture has perhaps no equal. Many skillful farmers consider a compost of one-half good muck and one-half stable manure fully equal for corn culture to pure stable manure. Vegetable composts, animal excrements, and muck are then the chief sources of carbonaceous manures. With these, as we have seen, are combined various gases and salts which are essential to vegetable growth, either as elements of nutrition or as stimulants. These may also be found in more concentrated forms and in smaller bulk, capable of more easy and direct application to growing plants. Variously combined and condensed, these fertilizing elements constitute the numerous articles known in commerce as artificial manures. All plants during their growth take from the soil more or less mineral matters. Some require them in large quantities. Such plants are said to exhaust the soil on which they grow. The small grains, which appropriate in their culms and seeds much silex, lime, and potash, are instances of this class. The elements of which we are now speaking are all soluble, and are washed out of the soil—and the better the soil is worked and the finer the tilth, the more rapidly does this take place—and, unless they are frequently renewed, the cultivated soil is soon exhausted of them. Owing to their small bulk they are easily applied. Nitrogenous manures are Peruvian guano, night-soil, poudrette, urine, hair, wool-waste, fish manures, and animal substances generally. The phosphates are bone-meal, superphosphate of lime, and Mexican guano. All these are combined with mineral earths and alkalies, and it is to these that is due whatever permanent value such manures possess, the other elements being so soluble and volatile that their effects are immediate and temporary. In this connection we may mention the saltpetres or nitrates, a class of manures to which little attention has been paid in this country. Earth containing nitrate of potash is often found in caverns, where it has been accumulating for ages, protected from the weather. Large quantities of it are imported from Chili. The nitrates may be manufactured artificially by means of nitre beds. These are formed by means of earth and animal manures mixed with potash, lime, and soda. They are protected from the rain by roofs open on all sides to the air. The mixture is kept at the proper degree of moisture, and frequently stirred to expose new surfaces to the atmosphere. Nitrates of lime, potash, and soda are formed, and the whole mass becomes impregnated with them.

MANURING. (See Manure.)

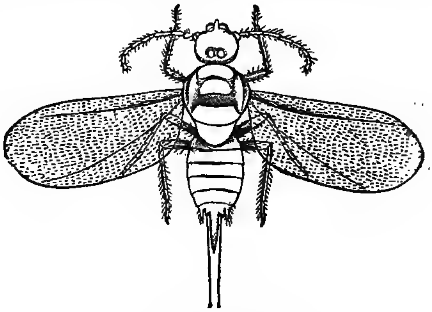
MAPLE. *Acer.* The maple family is an important one to the United States, both from the value of its timber, and for the saccharine juices which some of the species yield. These are notably the Sugar maple, or Rock maple, *A. saccharinum,* and the variety, *A. nigrum,* or Black maple. The Sugar maple is the variety that produces the Bird's-eye maple. The Red or Swamp maple, *A. rubrum,* and the Ash-leaved maple or Box elder, *Acer negundo,* or more properly, *negundo aceroides,* are also rich in saccharine juice. The other species are the White or Silver maple, *A. Dasycarpum;* Mountain maple, *A. spicatum,* a tall shrub, growing in clumps in rich, moist woods, and the Striped maple, *A. Pennsylvanicum,* known also as Striped maple and Moose-wood, a tree, small, slender, and with light green bark, striped with dark lines. The Norway maple, *A. platanoides,* is a foreign tree, a native of Europe, and, as an ornamental tree, finer in some respects than our own, with fine, abundant foliage, which continues green much later than our native maples. The great maple, *A. pseudo-platanus,* is also an European tree introduced into the United States, and sometimes planted. This and the Plane tree (*Platanus*) is sometimes called Sycamore. The true sycamore is, however, a species of fig, *Ficus sycamorus.* We should not advise the planting of either of the foreign named; our own Sugar or Rock maple, the Red or Swamp maple, and the White or Silver maple, are preferable. None can be finer than the Sugar maple in summer; and all, both the Sugar and the Swamp maple, are magnificent in their varying foliage, after the frost has touched the leaves in the autumn. The Ash-leaved maple is among the fastest growing of any of the family, a most ornamental tree, and every way worthy of planting when a quick effect is desired. The seeds of the Silver maple ripen soon after the leaves have become fully grown, and should be sown immediately. The seeds of the other maples, including the Ash-leaved variety, ripen in September and October. If the seeds are not sown immediately, they should be kept over winter in sand, just moist, and as cool as possible, even down to the freezing point. (See article Acer.)

MAPLE BARK LOUSE. *Pulvinaria Innumerabilis.* Miss Emily A. Smith, of Illinois, one of the most accomplished entomologists of the West, says of this insect: Although the soft maple (*Acer dasycarpum*) is generally one of the first trees attacked, yet they soon spread to the other species. The insects live by puncturing the bark, and the females soon become clothed with a white, cottony substance, proceeding from the posterior parts. In this the eggs are deposited. The cut of the insects, highly magnified, shows the female, and also their work on the bark; *a,* bark with insects at work; *b,* dorsal view; *c,* ventral view; *d,* beak. In the natural condition, the young insect settles down upon the leaves of the maple almost immediately after hatching, the preference being given the under side and near the midrib, although they are found upon the upper side to some extent; this is entirely owing to the number of insects upon the tree. When in a state of rest, the young lice draw the antennæ under and parallel with the last joint of the fore pair of legs, the two remaining pair extending backward. During the summer the young insects increase in size, and continually grow darker. They molt several times during their growth, and do so by shreds of skin peeling off and not cast off entire, as in the usual way. Although they seldom leave the position first assumed, during the summer, they have full use of their legs, since when the leaf is detached from the tree, the young lice will withdraw their beaks and move quite actively about in search of fresh food. When young, the males and females can not be distinguished one from the other, but in a few weeks the males cease growing and change into the pupa state. The male scale is lighter than the growing females, and becomes longer and narrow. As the transformation progresses, two anal stylets project from the posterior end, and soon after the end is slightly raised and the male comes forth, leaving behind on the leaf the whitish larval scale. These are found scattered about among the females, on both upper and under sides of the leaf. The male louse is very different from the female. During the pupa state he has acquired wings for the new sphere into which he is about to enter, and, although he still retains the legs and antennæ, the beak and mouth organs are wanting, since, in the short existence granted him, there will be no need of food. The males generally appear the latter part of the month of July, and continue some two weeks. They are very active, flying about the leaves with great rapidity. At this time, impregnation takes place, the males dying shortly after, while the females remain on the leaves and continue to develop. We find that this louse is single brooded, the females living a few weeks over one year, the eggs deposited the latter part of May, and the young lice appearing three weeks and a half after.



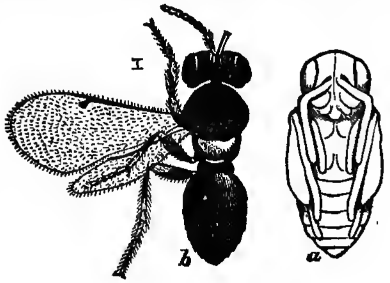
MAPLE BARK LOUSE.

That they settle down at once upon the leaves of the tree and remain until autumn, when they return to the under side of the leaves, remaining in this assumed position the remainder of their lives. The males appear in eight weeks after the young have hatched, and the females are then fully developed; in two or three weeks the males disappear entirely, while the females remain dormant on the limbs six months and a half of the entire year. It is well known that the varied temperature has great effect upon the length of time the insects remain in their several stages of growth. The manner in which this insect is conveyed from place to place is undoubtedly through the transportation of the trees, the scales of the female adhering to the limbs when transplanted. The insects spread from tree to tree by the aid of the wind when in the egg state, the waxy mass becoming detached from the tree in very stormy weather, and, being light, it is easily blown about. Many flies, wasps and bees are attracted to the trees by the sweet substance in the waxy mass, and the young lice, when crawling about, before settling down upon the leaves, will become attached to the legs of these insects and thus conveyed to other trees. Nature has made violent efforts to assist in destroying the *Pulvinaria innumerabilis*, and one of the most successful ways of combating with this destructive insect is by cultivating and protecting the natural enemies.



MALE MAPLE LOUSE.

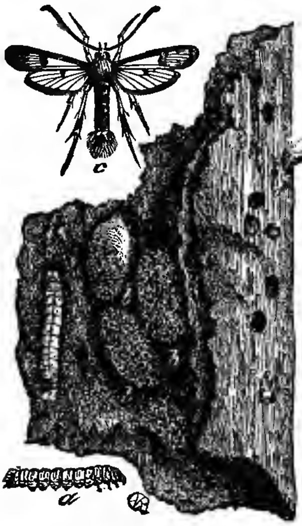
To the lady birds we are the most indebted for services in this direction, since, unlike many kinds of insects, they continue their work of destruction throughout their entire active life, the larva and imago subsisting upon the same kind of food. Three kinds of lady birds are very often found upon the infested trees during the summer months. The female maple louse has one true parasite, (*Coccophagus Lecanii*, Smith), which is double-brooded, and lives in the body of the female. The insect is small, having a black body and four membraneous wings. The perfect insect and the pupa are shown at *a*, and *b*, the hair lines denoting the natural size. When the imago is about to emerge, the dorsal part of the louse becomes very black and presents a rounder appearance; later the parasite makes a small circular opening, from which it takes flight. The first brood occurs in early spring, the second in August.



CHALCIS PARASITE.

Remedies: The fact that the young lice settle upon the under side of the leaf and limb, renders the use of fire extinguishers charged with liquid solutions possible and to good effect. When the lice are first hatched they are very small and delicate. A wash containing an alkaline solution applied at this time is sufficient to destroy them. By attaching a wire bag to a common sprinkling hose, filling the bag with soft soap and turning on the water, a soap-suds will be formed which will at once kill the insects. The scarcity of the water system in small cities renders this plan impracticable, however, and experiments led to a plan, easily attained by all, and which has proved successful the two seasons past. The plan recommended is as follows: Charge a fire extinguisher, in the usual manner, with bicarbonate of soda and sulphuric acid; add to the water one spoonful of crude carbolic acid to every eight gallons of water. Apply this to the tree; the force from the extinguisher will convey the fluid to all parts of the tree alike; the disposition of the insects to settle upon the lower surface of the leaf and limb serve to further this plan. Two applications should be made upon the same tree; the first, three weeks after the first deposition of eggs, and the second, four weeks from the first application. If the work is delayed, the insects become strong and the strength of the solution must be increased, which would be liable to injure the tree itself. The actual cost is not exceeding twenty cents an application, which is trifling compared to the cost of replacing the tree.

MAPLE BORER. Legged Maple Borer. (*Ægeria Acerni.*) This insect of late years has done extensive damage especially to shade maples in the West. Dr. C. V. Riley, in his sixth Missouri Report, says of this insect, that, vieing with the Flat-headed Borer in destructiveness, but generally following in its trail and rendering more conspicuous the damage which that species does to our shade maples, the insect under consideration deserves notice. It may be called the Legged Maple borer, because the possession of sixteen legs, at once distinguishes it from the Flat-headed Borer. It is, indeed, in structure similar to, and belongs to the same family as the common Peach-tree Borer, and the more common Current-stem Borer (*Æ. tipuliformis*, Linn.). The cut shows that the worm burrows under the bark of our soft maples, feeding on the inner bark and sap-wood and never penetrating deeply into the more solid heart-wood. It is so numerous at times that it completely girdles, and thus kills outright, trees of considerable size; while smaller trees are weakened, and rendered liable to be broken by wind, even where the worms are less numerous. The burrowings of the worm are filled with dark brown pellets of excrement, and cause the bark to crack open and loosen. The cocoon is loosely formed of white silk, and covered with the same brown excrement, and when about to give forth the moth, the chrysalis works its way partly out of the bark through a passage which, as larva, it has providently prepared, having left but the thin epidermis, which the chrysalis easily pushes through. The moth is a very pretty species, particularly distinguished by the large anal tuft of bright orange-red hairs It appears to be very generally distributed over the country; though, as none of the older eastern writers on economic entomology refer to its injuries, we may infer that it does not attract the same attention in the Atlantic as it does in the Middle States. The moths begin to issue from the trees the latter part of May, and continue to issue throughout the summer. The worms are also found of all sizes, during this time, and throughout the winter. I have always found the worms in such trees as have been injured, either by the work of the Flat-headed Borer, the rubbing of the tree against a post or board, or in some other way. Where the bark is kept smooth, they never seem to trouble it, the parent evidently preferring to consign her eggs to cracked or roughened parts. For this reason the worm is not found in the smoother branches, but solely in the main trunk. Whether the soap application will prevent the moth from depositing her eggs, is not known; judging from analogy, probably not. Yet it will tend to keep the bark smoother, and, in being used to shield the tree from the other borer, it will indirectly shield it from this one. Mr. Gennadius recommends whitewashing the trunks, and filling up all holes and fissures with mortar, so as to render the bark as smooth as possible.



LEGGED MAPLE BORER.

MAPLE-LEAF CHENOPODIUM. (See Goosefoot.)

MAPLE SUGAR. In the article Sorghum, will be found matter relating to sugar making, from the best data except that of making sugar from the true sugar cane, and making maple sugar. So far as condensing the sap of the maple is concerned and converting it into sugar the ideas expressed in the article Sorghum will apply. The tapping of the trees and gathering the sap, when there is a considerable sugar orchard, must be carried out systematically, and, when proper implements are to be obtained, it is cheaper that the best quality of these be bought. Yet, in many localities, it is difficult to procure modern utensils, especially in the settlement of a new country. Thus, we will suppose that one of the early settlers, a farmer, is going to engage in making maple sugar, he would commence operations in something like the following manner: The first thing to be done is to procure something in which to catch the sap, and just before the season for making sugar arrives, he takes his axe, goes into the woods where the work is to be done, and proceeds to make a sufficient quantity of troughs. These are generally made out of soft timber, such as will split freely and work easily; trees of about one foot in diameter are selected and cut into lengths of from two and a half to three feet;

these are split through the center, and the blocks thus made are dug out with the axe, and made large enough to hold from one to two pails of sap. He next wants some spouts to conduct the sap from the tree to the trough; these are made of some timber that splits well, and are made by cutting or sawing blocks one foot in length, and splitting them into thin, narrow staves. If a crooked frow can be obtained to split them with, they are of the desired form; but if they have to be split with an axe, as is frequently the case, then a shallow groove has to be cut on one side for the sap to run in; one end of the spout is sharpened to correspond with the shape of the tapping iron. This instrument is about one foot in length, and made of iron in the shape of a carpenter's gouge, the cutting end being about two inches wide and usually made of steel. When the sap will run, the trees are tapped by making two incisions on the body of the tree, near the ground, or as near as the snow will admit; these incisions are made in the form of the letter V; just below the point of these cuts, another is made with the tapping iron by driving it into the tree with the axe, and into this the sharpened end of the spout is driven, and under this spout a trough is placed to catch the sap. Previous to tapping the trees, a place is prepared to boil the sap; this is done by felling a large hard wood tree; from the butt end two logs are cut, the length of these depending on the number of kettles to be used. If only two are used, they would be about six feet long. These logs are placed on the ground parallel with each other, with a space between them wide enough to hang the kettles. At each end of the logs a crotched stick is set into the ground, and across these a pole is laid; from this pole the kettles are suspended. These are generally iron, and hold from twelve to fifteen gallons. In boiling the sap, when the logs are burned up, others are cut from the same tree and rolled up to supply their places. If the tree did not supply logs enough for the season, and others could not be brought conveniently to the fire, a tree was cut in another place and the boiling place removed. It was usually the custom, however, when it was desirable to have a permanent boiling place, to go in the fall or winter previous and cut and pile logs enough near the boiling place to last through the season; sometimes wood was cut and piled ready for use, but generally the wood used was green, and cut from day to day as it was wanted. The sap was gathered and carried to the boiling place in buckets or pails suspended from the ends of a wooden yoke, made to fit the shoulders of the person who gathered the sap. In gathering sap when the snow was deep, unless paths were made to go in, it was necessary to use snow-shoes to go around on the snow. Generally a rude shanty was erected near the boiling place, under which the tools that were used and sometimes a little dry wood were placed, and into which the man himself could also go when occasion required. Our fathers had but limited means for storing the sap when gathered; and during a good run much of it would be wasted, and during stormy weather much snow and rain would get into the sap. In boiling sap in kettles hung between logs, the wood to make the fire with had to be set endwise between the logs and kettles, and as the lower ends burned off, the tops of the small sticks would frequently fall into the kettles: leaves and ashes would occasionally be blown in by the wind, and when the sap was nearly boiled down to syrup it would burn on the sides of the kettles, thus giving the contents of the kettles an additional color. In some instances the syrup was strained through hemlock boughs, and then boiled down to sugar, if a mixture made by boiling such a compound together could be called by that name. Those who wished to make a nice article would strain the syrup through a linen strainer, then clarify it with milk or eggs, then strain it again and boil it to sugar. In this way a much better article of sugar was made than one would suppose. At the close of the season the troughs were turned bottom upwards by the tree, or set endwise against it, where they were ready for use next spring. The spouts were taken from the trees, and with the kettles and other tools, carried to the dwelling-house of the owner for future use. After a series of years wooden buckets began to be used in the place of troughs, and instead of tapping the tree with the axe and tapping iron, an auger was used. The trees were tapped by boring a hole into the tree from one to two inches in depth, and short, round spouts driven into the holes; an iron spike was driven into the tree a few inches below the spouts on which the bucket was hung by means of a hole bored through one of the staves near the top. A cauldron kettle was substituted for boiling the sap, and this large kettle was hung up to one end of a long pole resting on a crotched stick set in the ground; this pole was so balanced that when the kettle was filled with sap, the other end of the pole would rise and let the kettle down to the fire; but when the sap was boiled down low, the kettle would rise out of the way of the fire. The advantage of having it hung in this way was, that much less of foreign substances got into the sap while it was boiling; and if the person who was boiling the sap should be absent from the fire for some time, and the sap get low, it would swing up from the fire, and thus prevent it from being burned. After this, those who had cauldron kettles began to set them in arches made of stone, and these arches were generally protected from the storm by a shelter of some kind, at the same time the wood for boiling the sap was cut the season before it was wanted for use, so that it would be dry when wanted. Those persons having sugar lots near their dwelling-houses, accessible to a team, and having conveniences at their dwellings for boiling sap, drew it and boiled it there; the sap was gathered and put in barrels, and drawn on sleds to the boiling place. Soon after this, as there began to be a market for maple sugar, those engaged in the business began to build permanent houses and enlarge their accommodations and facilities for manufacturing. These sugar houses are generally built on the sugar lot, and were made large enough to contain not only boiling fixtures, but the storage for sap, the sap buckets when not in use, and generally the wood to be used. These improvements in the manufacture of maple sugar which have been mentioned would bring us down to about thirty years ago, at which time considerable attention had been given to the business, both in the manufacture of the sugar and the preparation of it for market. About this time sheet iron pans began to be used for boiling sap, and from thence a new era seems to have commenced in the business. It was soon ascertained that those who used these pans for making sugar obtained a much better article than those who used iron kettles, and that those who made the best sugar sold it for the highest price; and that while there were generally plenty of customers for a good article, it was often difficult to dispose of an inferior one at paying prices. These considerations, with the increasing demand for maple sugar have stimulated those engaged in the manufacture to make all the improvements that were possible, so as to produce a superior article at the least expense and with the least labor. The most approved way of building sugar houses now is to locate them so that the ground on one side of the house will be several feet higher than on the opposite side. The general plan of the house and fixtures for boiling and storing the sap is as follows: The house is made large enough to enclose the arch and store-tubs at one end, with the wood in the other end, and the sap buckets in the upper part. The arch is built near one side of the house, and on the opposite side is built a platform on which the store-tubs are placed. These tubs are so arranged that the sap can be drawn by means of a faucet in the bottom of the tubs into a spout, and run into the heater or pans. On the outside of the building the ground is fitted at such a height that the sap can be drawn from the bottom of the gathering tubs and run into the tops of the store-tubs. With this arrangement all the labor of lifting the sap after it is placed in the gathering-tubs or buckets and brought to the house is avoided; the only force used after this until the sap is in the pans is that of gravitation. In the sides of the building are doors, so calculated as to afford means for the steam from the boiling sap to pass off. The arches are generally built of brick, though where suitable stone can be obtained it is sometimes used. The arch is usually made wide enough to set on one pan and long enough to place one or two pans, as may be required, and a heater. The pans to be set first from the mouth of the arch, and the heater between the pan and chimney. The mouth of the arch is fitted with a cast iron frame and door. About eight inches from the bottom of the arch is a bed on which the fire is made; this floor is generally made of narrow, flat stones, with sufficient space between them for the coals and ashes to fall through into the lower part, and thus prevent the fire-place from getting clogged up, as it would do in boiling any length of time without the floor. In this arrangement of the floor, the draft of air passes under and up through the fire, throwing the flame and heat of the fire against the bottom of the pans. The pans are generally set directly on the top of the arch, which is made level and smooth for that purpose. The ends of the pans rest on iron castings made for that purpose. On the end of the arch where the heater is placed is fitted a cast iron frame, in which the heater sets. The pans for boiling the sap are made of Russia sheet iron, and are of different sizes, holding from one to four barrels. The size of a pan holding one barrel is two feet three inches long, and two feet wide on the bottom; a two-barrel pan, five feet five inches long and two feet wide; a three-barrel pan, five feet four inches long, three feet three inches wide, a one and a half barrel pan, four feet four inches long, and two feet wide. The depth of the pans is seven and a half inches. The sides of the pans usually flare about three inches on a side, which would make the top of the pan six inches wider than the bottom. Handles are placed on the sides of the pans near the top. The cost of the pans will vary with the price of iron and also the quality of the stock. The sap-heater is a modern improvement. Experience in the process of boiling sap has shown that whatever vessel is used, the larger the surface exposed to the fire the faster will evaporation take place, and that evaporation will proceed faster in shallow vessels than in deep ones; and on this principle the sheet-iron pan has been constructed. In the construction of the sap-heater the idea was to make a vessel in which a much larger surface of the vessel, and consequently the sap, would be exposed to the fire than was in the pan then in use. To accomplish this it was proposed to incorporate into a sap-pan the principle, and as far as practicable, the form of a high-pressure steam engine. The plan adopted was to make a pan, with a box or pit extending down from the bottom of the pan. Into this box were placed a number of tubes: the ends of tubes made tight to the sides of the the pit, and holes cut through the sides of the pit against the ends of the tubes. In making the pit the holes are first made in the sides; then the tubes fitted in. When the pan was placed on the arch the pit of tubes would be placed in such a position that the heat and smoke of the fire should pass through these tubes, thus exposing a very large surface to the action of the fire, and, consequently, when the vacant places between the tubes were filled with sap, a very rapid evaporation must take place. Another consideration in the use of the heater is, that no additional fuel or heat is required; the heater, being placed in the arch behind the pans, receives the heat from the fire after it passes from the pans, so that all that is accomplished in boiling with the heater is a clear gain in time and fuel. In using the heater it was found necessary to have the top part of it made high, to prevent the sap running over when boiling; for when the fires are hot the heater is filled with foaming sap. Even with the high top it is necessary to have one or two tubes or spouts in the side near the top, to let the boiling sap into the pan before it, and also to make the system of boiling arrangements complete, which will be examined hereafter. The sap-heater is made of the best quality of tin; the usual size is as follows: The upper part is nineteen and three-quarters by thirteen and one-quarter inches wide on the sides at the bottom, and eighteen inches high; the sides flare about two inches, so that the top is about four inches wider than the bottom. The pit is twelve and one-half inches deep. The tubes are thirteen and one-half inches long, and one and three-quarters inches in diameter. A pit of this size will contain thirty-five tubes, placed in five rows, seven tubes in a row. Near the top of the heater, on the side next to the pan, one or two tubes are placed to carry the sap from the heater to the pan. On the sides of the heater, at the top, are handles for taking it off. The cost of the heater is from eight to fourteen dollars, according to the size. The method of taking off the heater is to have a windlass directly over it. When the heater is not in use in boiling sap, a piece of sheet or cast iron, is used to cover the place in which it sets. To remove the pans from the arch when they contain hot sap or syrup various ways are used. The simplest and safest way is to have a strip of board nailed to the studs on the side of the house, the top edge of the board level with the top of the arch; then have two strips of board just long enough to reach from the side of the house to the bottom of the pan on the arch; have the upper side of the ends of the boards next to the pan beveled off to an edge; place these near the ends of the pans. After the greater part of the syrup has been dipped out of the pan, stand at the side of the arch between these boards; take hold of the handles of the pan and draw it upon the boards where it can be emptied of the rest of the syrup. The plan for boiling sap in the arrangement just described is, after the sap has commenced boiling, to have a stream of sap running into the heater, and from the heater into the pan before it, in which it is boiled down to syrup. If two pans are used, the sap is dipped from one to the other. The quantity of sap which can be boiled in a given time depends on many circumstances. Sap will boil much faster on a clear day than on a cloudy or stormy one, and weak sap will boil away faster than that which is stronger. With a three-barrel pan and a heater, with good wood and favorable weather, sap enough for eighty pounds of sugar can be boiled in a day as an average day's work. The kind of wood used may be either hard or soft, though it is now thought that equal parts of both kinds, mixed together, are the most economical. With one pan and heater the wood should not be cut over three feet long; some think two feet long enough. If the wood is too long it will clog up the back part of the arch with coals, so that the heater will not work as well. One cord of wood, (running measure,) two feet long, will boil as much sap as a cord four feet long. One cord of wood two or three feet long, is calculated to make one hundred pounds of sugar. The buckets used to catch the sap are made both of wood and tin, the wooden ones being generally used. These are made of pine lumber, hooped with iron, and painted with oil paint on both sides; at the top of the bucket, on the outside, is an ear made of sheet iron, through which is a hole large enough for the spike to pass on which it is hung. The spouts used for conveying the sap from the tree to the bucket are principally made of wood, although metallic ones are used to some extent. The wooden spouts are made of hard wood, birch making the best. They are made by taking inch boards, sawing them into strips one inch wide, then cut into pieces the length of the spout, which is about six inches; these are then put into a lathe and turned round and smooth, one end of which is tapered down to a little less than half an inch in diameter; a hole about one-fourth of an inch is then bored through the entire length, and the spout is ready for use. The spikes for hanging the bucket on the tree are made of wrought iron, and are about two inches in length, with the head on one side of the nail, to prevent the bucket from slipping off. A common half-inch bit is used for tapping the tree, though many use one seven-sixteenths of an inch for that purpose, and a one-half inch bit for boring the second time. In all sugar lots where the surface of the land will admit of a team being used, the sap is drawn from the different parts of the lot to the sugar house, on sleds. For this purpose a gathering-tub, holding three or four barrels, is used. This tub is made with a head in both ends, the diameter of the bottom being much larger than the top, to prevent it from tipping when filled. In the top of the tub a hole is cut large enough to turn in the sap; a lid is made to fit this hole, so that when the tub is full it can be closed tight, to prevent the sap from being wasted in going to the house. The tub is fastened on the sled with stakes or chains. The tubs in the house for storing are usually about the size of the gathering tubs; they have but one head, and the tops of these are the largest. Both the gathering and storing tubs are made of spruce or pine planks, hooped with iron, and usually painted on the outside. The storing-tubs should be painted on the inside like the buckets, to prevent them from becoming sour and discolored with mildew. Whenever storing tubs or buckets become sour, they should be immediately washed clean before putting more sap in them. In those lots where a team can not be used to draw the sap, a hand sled can be frequently used with advantage. Many of the sugar lots are located on the sides of hills so steep that neither teams nor hand-sleds can be used to draw the sap. In these lots leading spouts or pipes can be used in a way to save much severe labor. By having the sugar house located at the lowest part of the lot, lines of leading spouts can be put up from the house to different parts of the lot, and in these spouts the sap can be run from those places to the house. Spouts can not be used when it snows, as the snow that falls into them will choke up the passage of the sap, so that it will run over and waste. In rainy weather considerable water will collect in the spouts if the line of spouts is a long one. At the upper end of the line a store-tub is placed; by means of a faucet the sap is drawn into the spouts, and the size of the stream gauged to their capacity. Pipes are a great improvement on the wooden spout. It can be used as well in stormy as in pleasant weather. The size of the tube generally made is one-half inch; one end of these spouts is made a little larger than the other, so that the ends will fit tight in putting them up. The quantity of sap which different trees produce varies largely; some will produce as many pailsful as others do quarts. As a general rule, second-growth trees that have the most top will produce the most sap; with first-growth trees the difference is not as great. Trees standing in open land will produce much more sap than those growing where the timber is thick. Sap varies much in saccharine strength. Trees growing in open fields, or in exposed places produce a sweeter sap than those growing in the forest. Some years the sap will produce much more sugar than in others. Taking one year with another, eight pounds of sugar to a barrel of sap is a good average yield. Sap requires to be reduced to about one-twentieth of its bulk, to form good syrup. In making maple sugar or molasses, one thing is indispensably necessary in order to make a good article; that is, cleanliness in every process from the time the sap is collected till it is made into sugar. Great care should be taken that all the implements used to hold the sap or syrup should be kept clean and sweet. The same care should be taken to prevent all foreign substances, such as bark, leaves and dirt, from getting into the sap, and also to remove them as soon as possible, whenever they do get in, as everything of this nature has a tendency to impart a dark color and also an unpleasant flavor to the sugar. Sap usually runs best in pleasant weather, when the air is clear and wind west—an easterly wind dries up the sap—but at this season of the year, changes of weather and storms are frequent, and if it can be avoided, sap should not remain out to be exposed to the storm, as water from any source injures the quality of the sugar. Experience has shown that the sooner the sap is converted into sugar after it leaves the tree, the better; and especially is this the case when the weather grows warm; for the sap is liable to sour in the buckets, and also in the store-tubs. When the weather is quite warm—as it sometimes is for a day or two—sap will sour in twenty-four hours. At such times the boiling should be forced to the utmost extent, night and day, if necessary. At no time should much sap be allowed to accumulate on hand, if it can possibly be avoided. After the sap has been gathered, if there is dirt in it without ice, it may be strained as it runs into the pans. After the boiling has commenced, it should be kept up without cessation until it is reduced to syrup. Twelve hours is long enough to boil at one time for syruping off. The syrup should be boiled down as thick as it can be strained when taken from the fire. Whatever dirt and scum arises on the surface of the sap when boiling should be removed with a skimmer. As soon as the syrup is taken from the fire, it should be strained into a tub used for that purpose, and allowed to settle. The best strainers are made of home-made flannel—one thickness of cloth answering for a strainer. After the syrup has settled, it should be made into sugar. Pour off that part which is clear into the pan or kettle to be used in boiling it, leaving the sediment in the tub. By turning some hot sap into this it can be settled again, and either boiled down by itself or with the next lot of syrup. It was formerly the practice to clarify the syrup with milk or eggs, to remove the impurities; but if the syrup be well settled it needs none, for the simple reason that there are no impurities to remove. After the syrup is placed on the fire it should be kept boiling with a steady fire until it is done. Sometimes, while boiling, it is inclined to run over. To prevent this, put a piece of butter the size of a marble into it, and sometimes it may be necessary to put in a second or third piece before it will settle. A very good way is to take a stick long enough to reach across the vessel; lay this stick across the top of it, and from the stick suspend a piece of fat pork; when the syrup rises against the pork, it has the same effect as the butter. If neither of these methods will prevent the syrup from running over, the heat of the fire must be reduced until it boils steadily. The degree of hardness to which the sugar needs to be boiled depends on the subsequent treatment. If it is to be put into tubs and drained, it should be boiled only enough to have it granulate readily; if it is to be put into cakes, it should be done so hard that it will not drain at all; it is necessary to boil it as long as it can and not burn. There are various ways of telling when the sugar is boiled enough. A convenient and good way is, when snow can be obtained, to have a dish of snow, and when some of the hot sugar is put on the snow, if it does not run into the snow, but cools in the form of wax on the surface of the snow, it is done enough to put into tubs to drain. But when it is to be caked or stirred, it should be boiled until, when it is cooled on the snow, it will break like ice or glass. When snow can not be obtained, stir some of the sugar in a dish, and as soon as it will granulate, it is done enough to drain; when it will form bubbles, feathers, or ribbons, on being blown, it is done enough to cake or stir. To try it in this way, take a small wire or stick and form one end into a loop; dip this loop into the sugar and blow through it to produce the forms described. When the sugar is done it should be taken from the fire immediately, and cooled. It is then ready to be put up in any way that may be wanted. In large places, or where large quantities of sugar are made and the syrup is sugared off at the sugar house, a one-barrel pan fitted to a small arch is used to make the sugar in; but when the sugaring-off is done on the stoves of the dwelling-houses, as large quantities of it are, smaller pans or brass kettles are used. These pans are made of sheet iron, tin and copper; a convenient size is one of twenty-two inches long by thirteen wide on the bottom, and thirteen inches high, with handles on the ends. From forty to fifty pounds of sugar can be made in a pan of this description. The general method of putting up maple sugar for family use is to place it in tubs and drain it. When put up in this way, the sugar should stand long enough after it is taken from the fire to become well crystallized before it is put into the tubs. The best tubs for this purpose are those holding from one to two hundred pounds, made flaring, largest at the top, and having two bottoms. There should be a space of several inches between the bottoms, to contain the molasses which drains from the sugar. The upper bottom should be fitted loose, so that it can be taken out when the tub is empty. In this bottom one or more holes should be made for the molasses to drain through. When the tubs are to be filled with sugar this hole should be stopped with a stick long enough to reach above the top of the tub. After the first batch of sugar put into the tub has become hard, the stick should be loosened and raised a little, and this process continued until the tub is filled. The molasses will drain through this hole into the receptacle below the sugar, where it is secure from dust and insects, and when wanted for use it can be drawn out by means of a faucet in the side of the tub. Many families are in the habit of stirring a portion of their sugar, as in this form it retains its flavor better than when it is drained, and is in a more convenient form for use. When the sugar is to be stirred it should be boiled hard enough to cake. When it is done, take it from the fire, set the pan in a cool place, and with a wooden paddle commence stirring it briskly, and continue to do so until the sugar is grained and dry, or of the consistency of the brown cane sugars. If it is then put into tight boxes or tubs and thus kept, it will retain the fresh maple flavor for some length of time. When the sugar is to be caked, it should be allowed to stand after it is taken from the fire until it is partially grained, when it should be run into the moulds. Care should be taken not to let it get too cold before it is put into the moulds, for it hardens so fast at this stage that it must be handled quickly in order to cake in good form. If it is desirable to have the sugar of a coarse grain, it should not be stirred while it is crystallizing; but if a finer grain is wanted by stirring it moderately, while cooling, any desired grain can be obtained. Both wooden and tin moulds are used to cake sugar in, and these are made of different forms and sizes—the weight of the cakes varying from two ounces to several pounds. The general form of the cake is a square, as this is the most convenient one for packing in boxes, in which form it is put up for market. Previous to putting the sugar into moulds, they should be wet with water as this prevents the cakes from sticking. After the sugar is removed from the moulds, they should be washed before they are filled again. In draining sugar most of the coloring matter can be taken out and a white sugar obtained; but in this process much of the maple flavor is lost. The method is to cover the top of the sugar with wet cloths, flannel generally being used. These cloths should be wet and also washed daily in cold water until they are removed from the sugar.

MARASMUS. Leanness, wasting away.

MARBLE. Limestones with a granular and crystalline appearance; they are for the most part primary or transition. The colors and variegations are adventitious, depending upon the presence of other minerals. Good marble being entirely carbonate of lime, yields fifty-six per cent. of lime when well burned.

MARC. The matter which remains after the pressure of fruit; or any substance which yields oil; or, in fact, any fluid matter for the separation of which the action of the press is required. What remains in the press is the marc.

MARCESCENT. In botany, a term applied to leaves, etc., which are permanent, and when withered do not fall off.

MARE. The mature female of the horse. (See Horse.)

MARE'S TAIL. *Hippuris vulgaris.* A curious indigenous aquatic, growing in marshy situations, and in ditches, pools, and the borders of slow streams.

MARGARIC ACID. An acid obtained from animal fat. It derives its name from its resemblance to pearl. Its appearance and properties very much resemble those of stearic acid, another product of animal fat, the chief difference being in the greater fusibility of the margaric, which melts at 140° Fahr.

MARGARINE. The solid white fat of oils. A margarate of glycerine.

MARGARITIC ACID. One of those fat oils peculiar to castor oil.

MARGARONE. A product of the distillation of margaric and stearic acids; a white, pearly mass.

MARIGOLD. *Calendula.* A genus of showy plants, among which is the old and well known common marigold (*C. officinalis*). This species was formerly used in soups and broths, but is now little regarded. Some of the newer varieties are beautiful.

MARINE ACID. Muriatic acid.

MARINE SALT. Common sea salt.

MARJORAM. *Origanum.* A genus of well known, pungent, and gratefully aromatic herbs. The plants are all of easy cultivation; the shrubby kinds are increased by cuttings or slips; the herbaceous species by dividing at the roots. The species generally cultivated are the common or pot marjoram (*O. vulgare*), and sweet or summer marjoram (*O. majorana*), and bastard or winter marjoram (*O. heracleoticum.*) A light, dry, and moderately fertile soil is required for their healthy growth; and if it is one that has not been cropped for a considerable time, it is the more favorable for them. If the soil is wet or rich, they are deficient in their essential qualities, and the perennials are unable to withstand severe weather. The sowing is performed either in drills, six inches apart, or broadcast; in either case the seed being buried not more than half an inch deep. The tops and leaves of all the species are gathered when green, in summer and autumn, for use in soups, etc.; and dried in July or August, just before the flowers open, for winter's supply.

MARKETING CROPS. The marketing of crops is not the least important of the various divisions of agriculture. Here the farmer becomes the salesman, and as much tact, combined with strict integrity, is necessary here as in selling any product whatever. In the city or village, certain individuals become known for their produce being precisely as represented. In this case the buyer of grain takes it, the price being fixed according to the sample shown. If the farmer understands the ruling value of the commodity, but little trouble is experienced in selling in any market where there is competition. If there is no competition so much more the necessity that the seller knows the precise money value of the article to be sold. In the case of grain, he must understand the various grades, and prices. If live stock, the price according to fatness. If wool, the grade, whether it be fine, coarse, middle, or combing wool, and the price according to cleanness, and uniformity in packing. If butter, cheese, eggs, or other minor products of the farm, the seller must be competent to state the quality exactly, and then he can always fix a price anywhere in reason. The buyer is never deceived in the goods he examines, but may be in the statement of the seller, if he relies on his word. The buyer is an expert, or should be. So should be the farmer. Thus neither party will be deceived by misrepresentations of the other. In the case, where articles are to be consigned to a commission man in some distant city, a statement should be sent, detailing articles, quality, number of packages, weights, gross, tare and net, or number of bushels, or count, including bill of lading—is especially important in the case of butter, cheese, eggs, vegetables, fruits, berries, etc. If grain, samples should be forwarded by express, in case it is to be sold to arrive. In the case of perishable articles, as vegetables, etc., that are delivered from teams from day to day, these products should be carefully gathered, washed, when necessary, and tied in bunches, packed in uniform packages, of a bushel or integral parts of a bushel, unless sold by the bushel from the measure. The marketman soon learns to display his products in the most inviting manner, consistent with close packing in the wagon. As to market systems, all large cities are provided necessarily with market laws more or less stringent. In New York the market system includes fourteen or more principal market houses, and the firms of butchers and grocers, distributed over the city, who deal in vegetables and fruit. In St. Louis the regular market houses do the principal part of the trade. In Chicago, certain streets, as portions of Water and Market streets are occupied by marketmen, who sell the products consigned to them to butchers and grocers who supply the families direct. It is well understood, however, that in our great cities the inhabitants can not depend upon getting their supplies at regular market houses, directly from hucksters. This has been found to be the case in Boston and New York, and the evils of this system has tended to prevention of this system in the newer cities of the West. Philadelphia has probably the most perfect system of market houses in the country. Philadelphia has for generations been noted for the excellence of its market system. The law provides that vegetables, provisions, or fruits, exposed for sale shall not have been previously purchased within the limits of the city. When the city erects a market house, one-half of the building remains free for the use of the country people attending the market; and no fees, tolls, or perquisites are to be exacted from them for the use thereof. Persons who send or carry the produce of their farms to market, may sell beef, mutton, etc., slaughtered on their farms; and persons so selling such meats, etc., are not liable to any fine for selling in less quantities than one quarter; provided that farmers using the stalls in the market houses for such purposes shall pay a rent or compensation for each stall not exceeding $20 per annum. The select and common council annually elect a commissioner of market houses. No person is allowed to sell or expose for sale, elsewhere within the market limits than in the stands specially provided therefor, any fruits, vegetables, or other provisions (except fresh fish, meat, or flour) which have been before purchased within the city of Philadelphia. No person exercising the trade of a butcher is permitted to occupy a stand or station without the market house free of rent; and no person is allowed to offer for sale any veal, beef, lamb, etc., unless the same is the produce of his or her own farm, upon any of the streets authorized for the stands for market wagons, under a penalty of $20. The stalls and stands within the public market houses, and places for the use of which rent may be lawfully charged, are let annually. No person is allowed to use steelyards or spring-balances within the market houses. No person, except farmers bringing the produce of their farms to market, is allowed to sell or expose for sale any butcher's meat in any streets or other highways of the city south of Lehigh Avenue, east of the river Schuylkill, or north of Morris street, in any cart, wagon, etc., nor carry about the same for sale. The execution of these regulations provides better marketing than some towns of one-fifth her population. On Wednesdays and Saturdays, in the afternoon, thousands of pounds of butter, poultry, meat, and sausages are sold to consumers by farmers from all the counties within thirty miles of the city. The drawback to this system is that the poor are required to go considerable distances daily for their marketing. Nevertheless, prices should be enough cheaper to make it up, when the produce is sold direct from the producer to the consumer. In Chicago, the market business is all done through middlemen who receive the fruits, vegetables, etc., from the producer, and sell to those who supply the families. The commission man receives from five to ten per cent., and the retailer from ten to twenty-five per cent. Nevertheless, but little complaint is heard, except from fruit growers who have to pay a heavy additional tax in the shape of freights, sometimes carried several hundred miles. Chicago is the greatest fruit distributing market in the country, and in no market are fruits and vegetables cheaper or more abundant.

MARKET GARDENING. (See Gardening.)

MARL. A mixture of earths containing a large amount of mild lime. It is clayey or argillaceous when it has the mechanical characters and touch of clay, sandy when silicious, and calcareous when almost entirely composed of mild lime; it is also shelly when full of fossil shells. There is one feature common to all true marls, viz., effervescence with acids. Marl may be derived from ancient formations, more especially the upper red sandstone, but is for the most part of tertiary origin, or modern, being produced in ponds and rivers flowing in limestone countries. The richest shell kinds are best, as they contain bone earth. The value of marls is precisely as the amount of lime they contain. When very rich, they may be burned for quicklime, which much increases their activity and value. Marls seldom contain more than twenty per cent. of carbonate of lime associated with sands or clay. They are applied at the rate of fifteen to thirty loads to the acre, and do much good by altering the texture of some soils, as when a clay marl is applied to sandy lands. In some cases one hundred loads have been applied. They are chiefly indicated where the soil lacks lime, or may be improved mechanically; but being, for the most part, mineral composts, marls are usually serviceable, and often extremely beneficial, especially to poor, sandy lands. Shell and coral sands are of the nature of silicious marls, but more active, from containing organic matter.

MARMORATUM. In building, a cement of pounded marble with lime.

MARSH-MALLOW. *Althæa.* This is a genus of tall, free-flowering plants. The biennial and annual kinds should be sown in the open border in spring, and transplanted when sufficiently strong. The herbaceous kinds may be increased by dividing the roots or by seeds. *A. rosea*, the parent of the many beautiful varieties of hollyhock, yields a blue coloring matter equal to indigo. The common marsh-mallow (*A. officinalis*) is in England an indigenous perennial, growing abundantly in marshes, especially toward the sea. The root is perennial, tap-shaped, rather woody. Bees are very fond of its melliferous flowers. The whole plant, especially the root, yields in decoction a plentiful, tasteless, colorless mucilage, besides a fatty oil, uncrystallizable sugar, starch, and phosphate of lime. It is emollient, and salutary in cases of internal irritation. A syrup made with the root, as well as the decoction, is an officinal preparation used in the coughs of children.

MARSH-MARIGOLD. *Caltha.* The species of this genus are showy, and do best in a moist situation, but will grow and flower in a common border. They may be increased by seeds or divisions. The British indigenous species are two in number, viz: The common marsh-marigold (*C. palustris*) which grows in marshy meadows, and about the margins of ponds, rivers, and brooks, almost everywhere. It is perennial in habit, blooming in March and April. The root is thick and somewhat tuberous, with many simple fibers. Stem twelve or eighteen inches high, round, hollow, leafy, branched, furrowed. Leaves variously heart-shaped, rounded. Flowers from three to five, large, bright, yellow, on alternate solitary stalks. The flower-buds, pickled, serve for capers, which they resemble, except in having numerous germens. A double variety is frequent in gardens. Creeping marsh-marigold (*C. radicans*). This species is found by the sides of lakes and rivulets in Scotland, and is scarcely half the size of the common *C. palustris.* A double variety of this is cultivated near London.

MARSH MIASM. The pestilential effluvia from marshes, producing agues and intermittent fevers.

MARSUPIALS. Quadrupeds with an abdominal pouch, in which their young reside, as the opossum, kangaroo.

MARTINGAL. An attachment of the bridle fastened by a strap to the girth and furnished with two straps carrying rings, through which the reins pass. It prevents the horse from tossing his head.

MARUM. Bitter. In botany, the term is used to signify an herb with a strong smell.

MASCAGNIN. Native sulphate of ammonia, found in volcanic districts.

MASH. A soft diet occasionally given to horses. It is prepared by pouring boiling water upon a small quantity of ground malt, bran, or other similar substance, in a pail, so as just to wet it well. After this has been done, it should be well stirred about, till it is thoroughly mixed and sweetish to the taste, when, after becoming lukewarm, it is in a proper state to be given to the animal. It is frequently used after purges to increase their operation, as well as after hard labor, and in the time of disease. Mashes are very useful for restoring animals in these circumstances.

MASONRY. The art of building, especially with stone.

MASSETER. The muscle which moves the lower jaw.

MASSICOT. Yellow oxide of lead.

MAST. The nuts or seeds of the beech, oak, chestnut, and other nut trees. (See Acorn.)

MASTIC. The resin of the *Pistacia lentiscus*, extensively used in making varnishes; also a cement used in plastering walls.

MASTIFF. The largest of watchdogs. He has small drooping ears, smooth skin; is variously colored, hanging lips, large jaw, and is strong, and sometimes savage.

MASTOID. Small knots or elevations on bones, etc.

MATERIA MEDICA. The collection of drugs used in medicine, farriery, etc.

MATRASS. A chemical flask, with a long neck, used for heating or boiling fluids.

MATRIX. A womb. A place where anything is formed. The mineral in which metallic ores or choice crystals are imbedded.

MATTER. Anything that has weight or sensible properties, as divisibility, impenetrability, extension. It is organized or inorganic, elementary or compound.

MATTOCK. The pickaxe. The ends may be pointed or of the figure of a chisel.

MATURATION. Ripening. The formation of pus in abscesses.

MAT WEED. The sea reed.

MAUL. A large mallet, or beetle, to split wood.

MAW. The stomach. Maw skin, the prepared stomach for rennet.

MAWBOUND. (See Gastritis).

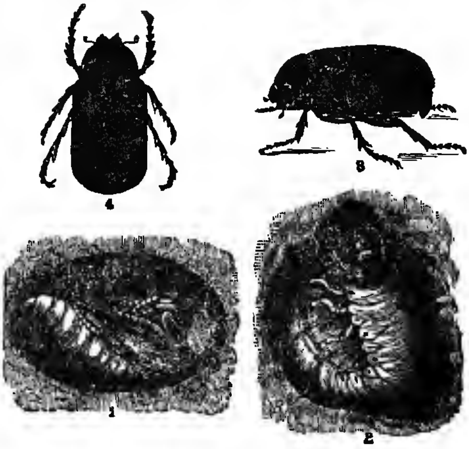
MAW SEED. The small Poppy, which see.

MAXILLA. The jaw. In zoology, it means the upper jaw; in entomology, the inferior pair of jaws.

MAXILLARY. Related to the jaws, as the maxillary glands, arteries.

MAY APPLE. *Podophyllum peltatum.* Wild mandrake. An herbaceous perennial, growing in moist woods, bearing one stem with two leaves; the roots are cathartic; the yellow fruit, often two and a half inches long, is acid and pleasant; it is worthy of cultivation.

MAY BEETLE, JUNE BEETLE. *Lachnosterna fusca.* This is one of the greatest pests of meadows, and occasionally of pastures. Pastures, however, are not so liable to be severely injured when fully fed down, since the continued tramping of stock is not favorable to either the egg or the future growth of the insect. Cereal crops also suffer sometimes to a fearful extent, and once the grubs are found in numbers it is better that the land be plowed and summer fallowed, since the grub requires to live three years in the larval state before transforming to the perfect bettle. We have seen large tracts of meadows, so completely eaten off about an inch under the surface that the sod could be rolled up like a carpet, and, of course, the field as a meadow was rendered worthless. A heavy sowing of salt will kill the grub, but to be effective, it must be heavy enough to kill vegetation. Hogs are persistent hunters of these grubs, and if turned into a field infested will soon rid it of these pests, but, of course, also at the expense of the crop. The cut shows the insect in its several stages, as at 1, the pupa; 2, full grown larva; 3, beetle side view; 4, the same, back view. In relation to the



MAY BEETLE.

application of nostrums, as salt, ashes, lime, etc., to kill these insects, it must be remembered that the first year of their lives they do comparatively little injury. The second year, unless in great numbers, the damage is not always particularly noticed. The third and last year of their life the farmer resolves to destroy them in earnest, and applies liberally the so-called specifics. The succeeding year they are not found, and he rejoices in the efficacy of the doses, but if he be an observing man, he will find the May Bugs (beetles) flying in great numbers. Here is the time to destroy them by killing them wherever found. Among the most effective means, the beetles being nocturnal, is to place torches, fed with kerosene or petroleum, in the fields. The beetles will fly to the light, and their wings being scorched, they are incapable of further mischief.

MAY TREE. The hawthorn.

MAY WEED. *Matricaria chamomilla*, and other plants. Perennial rooted, composite herbs, overrunning rich cultivated lands; they should be mowed before flowering, and exterminated by cultivating hoed crops.

MEAD. A wine made by fermenting one part honey boiled in three parts water, or so the liquid will bear out an egg the size of a ten-cent piece; and flavored with various aromatic herbs, according to the taste.

MEADOWS. Lands seeded down to grass to be cut for hay are termed meadows. Those used exclusively for grazing are pastures. Nevertheless, a meadow does not become a pasture simply because the aftermath is eaten off on the ground. The seeding of meadows is for an entirely different purpose than that of pasturage. In meadows the idea is to select such grasses as will furnish the heaviest swarth of palatable and nutritious hay, and which shall ripen together. The principal hay grasses in the United States are, North, Kentucky blue grass, orchard grass, fowl meadow grass, smooth stalked meadow grass, tall fescue, timothy, and red top. When Kentucky blue grass ripens in June the other grasses will ripen as follows: orchard grass, June; fowl meadow grass, July and August; smooth stalked meadow grass, July; tall fescue, June; timothy, July; red top, July and August. In seeding meadows more or less clover is generally sown. If with timothy and red top as the basis, the clover must be allowed to get pretty ripe in order that the timothy may be cut when the seeds are half formed. Then the red top will be in its prime, and the clover will have thickened at the bottom. Blue grass, orchard grass, tall fescue and clover ripen nearly enough together, so they may form the meadow; fowl meadow grass and red top ripen nearly enough together so they may be fit for hay at the same time. Clover, timothy, blue grass and orchard grass like a strong, rather dry soil, red top will grow in moist soil, so will fowl meadow grass. Timothy should not be cut close, since the bulb at the top of the ground will be injured. Clover, red top, fowl meadow, smooth stalked meadow grass, and blue grass make excellent hay for cattle and sheep. For horses, timothy, orchard grass, and blue grass make superior hay, since the hay is clean and generally free from dust. In the South, clover, blue grass, orchard grass, timothy and red top do fairly, but in the Gulf States the main dependence seems to be on crab, crowfoot, Bermuda and gama grass, which are extensively sown. What is necessary, North and South, is careful experiments with various grasses both for meadow and pasture. If a meadow is to be pastured it should not be a timothy meadow, that is intended for seed. The bulb is injured, the seeds of other grasses come in and the timothy is ruined as a seed crop. For shipping, clean timothy sells better than any other hay, especially in city stables. At the stock yards, mixed hay is not objected to if well cured. In the seeding of meadows plenty of seed should be used. It gives a better stand, and finer hay. All the grasses may be sown in the latter part of summer. If the grass miss, sow again in the spring. Clover should only be sown in the spring, and that as early as possible. (See article Grasses.)

MEASLES. This is a parasitic disease of swine producing peculiar small cysts, scattered through the muscular and other tissues. These cysts contain the form that produces the tape worm in the intestines of the human family. If the flesh is cooked most thoroughly, these bladder worms as they are called are destroyed, but it is better not to eat it. A hog with the measles, will have a cough, a discharge from the nose, running from the eyes, weakness of the hind parts, general debility, and there will be small pustules on the skin. Small doses of sulphur and saltpetre is recommended, daily for several weeks. Still there is little evidence that this or any other medicine will kill the worms. Once encysted they cause the animal very little further trouble.

MEASURES. Measure is of length, breadth, and thickness, estimated by known lengths, or compared by other known quantities: Thus there are 12x12x12=1728 cubic inches in a cubic foot; and 3x3x3=27 cubic feet in a cubic yard. The following collated from the Library of Reference, will show at a glance, the measures of capacity, weight, length, and time, both ancient and modern. Measures of capacity are:

The Imperial gallon is 277,274 cubic inches. A gill, or quarter of a pint, is 8⅔ inches.

The Imperial gallon contains 10 pounds avoirdupois of distilled water, weighed in air, at 62°, with the barometer at 30 inches. Two gallons a peck, eight a bushel, and eight bushels a quarter.

One English wine gallon is equal to .0833111 Imperial gallons.

One ale gallon=1.017045 Imperial.
One corn bushel=0.96943 Imperial.
One Imperial gallon=1.20032 wine gallon.
One Imperial gallon=0.933241 ale gallon.
One Imperial gallon=1.03152 corn gallon.

An Imperial gallon is 4.843452 litres.

Heaped measure, per bushel, is 2815¼ cubic inches clear.

The standard bushel kept at Guildhall contains 2145.6 cubic inches of water, weighing 1131 ounces and 14 pennyweights.

The Winchester bushel is 18½ inches diameter and 8 inches deep, containing 2150.42 cubic inches.

A quarter of corn is the fourth of a ton, and eight bushels, or two sacks.

A strike is four pecks.

1000 ounces of rain water are equal to about 7½ gallons wine measure, or to a cubic foot.

7 pounds avoirdupois is a gallon of flour.

A chaldron of coals is 58⅔ cubic feet.

Twelve wine gallons of distilled water weigh 100 pounds avoirdupois.

Nineteen cubic inches of distilled water, at 50°, weigh 10 ounces, Troy.

A cubic inch of distilled water at 62°, in a vacuum, is 252.724 grains.

The Imperial measure for heaped goods contains 80 pounds avoirdupois of distilled water, and is 19½ inches from outside to outside at the bottom; the heap to be in a cone at least six inches high from the outside; three making a sack and twelve sacks a chaldron, which ought to weigh 28 hundredweight.

The Imperial dry bushel, when not heaped, is 2218.192 cubic inches; the peck 554.548; gallon 277.274, and quart 69.3185. The bushel is 8 inches deep, and 18.8 wide; with a heap 6 inches high.

A tun is 2 pipes, 4 hogsheads, 3 puncheons, 8 barrels, or 252 gallons. A pipe of port is 138 gallons; of Lisbon 140; Madeira 110: and sherry 120. The hogshead of claret is 57 gallons, and the anm of Hock 36 gallons; Teneriffe 120, and Cape 20.

A tun of wine is 2 pipes, and each pipe 2 hogsheads of 63 gallons.

A tun of beer is two butts, and each butt 2 hogsheads of 54 gallons.

A bushel of wheat is 60 pounds, rye 53, barley 47, oats 38, peas 64, beans 63, clover seed 68, rape 48 pounds.

53 hundred weight is a chaldron at Newcastle, England. A keel of 8 Newcastle chaldrons is 15½ London chaldrons.

The Imperial corn bushel of 2218.192 cubic inches, is to the Winchester of 2150.42, as 32 to 31.

The Imperial coal bushel of 2816.459 inches is 1⅛ inches more than the old coal bushel of 2814.9.

The Imperial wine measure is to the old measure as 6 to 5; 5 Imperial gallons being 6 wine gallons and one forty-five hundredth over.

The new and old ale measures are as 60 to 59.

To convert old corn measure into new, multiply by .96943 or thirty-one thirty-seconds; wine by .83311 or five-sixths ale by 1.01704 or fifty sixtieths.

Wood, the fuel of France, is sold by the corde of 576 square feet: and 80 square cordes make what is called a journal.

At 70° the specific gravity of water is 0.99913; at 38° is 1.00113; and at 54° is 1.00064. The difference between 62° and 39° in a gallon of 277.276 inches is one-third of a cubic inch.

A last is a commercial measure, of twelve barrels of soap, ashes, herrings, etc.; ten quarters of corn, or two cart loads; twenty-four barrels of gunpowder; twelve sacks of wool; and 1,700 pounds of flax or feathers.

A Scotch pint is four English pints.

A Scotch pint is 105 cubic inches, and a wheat firlot 21¼ Scotch pints.

The Scotch quart 206.8 cubic inches.

A tub of butter is 84 pounds and a firkin 56 pounds.

A Scotch boll is an English sack.

A soldier's canteen contains three pints.

A litre is 61.0279 English cubic inches, or 2⅛ wine pints.

The stere, or cubical metre, is 35.3171 cubic feet English.

There are 545,2670,000 cubical yards in a cubic mile,

A Roman quadrantal was a cube containing 80 pounds of water, or 48 sextaries and 8 congii. A gower was 7 pints.

The *Ephah* was the sixth part, or 1747.7 cubic inches, nearly an English cubic foot.

The Winchester bushel is 35.2466 litres. The stere is 35.317 cubic feet.

MEASURES OF WEIGHT.

Weight is the tendency or force with which bodies of various density tend to fall toward the earth.

The standard of weights is the cubic inch of distilled water, weighing 252.458 troy grains; the troy pound 5760 grains, or 22.8157 inches. The same standard of 7,000 troy grains makes the pound avoirdupois, 27.7274 cubic inches: ten of which or 277.274 being the Imperial gallon; a quart 69.32; and a gill, of 5 ounces of water, equal 8.664.

In Troy weight, 24 grains make a pennyweight, (meaning grains of wheat) 480 an ounce and 5760 a pound.; or 20 pennyweights an ounce and 12 ounces a pound.

In Apothecaries' weight, twenty grains make a scruple, 60 a drachm; and then as in troy weight, 480 makes an ounce, and 5,760 a pound. There are 12 ounces to the pound, 8 drachms to an ounce, 3 scruples to a drachm, and 20 grains or drops to a scruple. The drachm is 60 grains.

In Avoirdupois weight, 16 drachms make an ounce; 256 a pound; 16 ounces a pound; 112 pounds a hundredweight; and 20 hundredweight or 2,240 pounds, a ton, English. The American ton is 2,000 pounds.

175 pounds troy are equal to 144 pounds avoirdupois; and 175 ounces troy are equal to 192 ounces avoirdupois.

80 ounces avoirdupois are equal to 73 ounces troy, and 14 pounds avoirdupois to 17 troy. A troy pound is 13 ounces 2.65 drams avoirdupois; and a pound avoirdupois is 1 pound 2 ounces 11 pennyweights 16 grains troy.

The avoirdupois pound of 7,000 grains is 453.61 French grammes; and the troy pound, 5,760 grains, is 373.14 grammes.

One troy pound=0.822857 Imperial pound.

One Imperial pound=1.215271 pounds troy.

Henry III, enacted that an ounce should be 640 dry grains of wheat; 12 ounces a pound; 8 pounds a gallon of wine; and 8 gallons a London bushel. Latterly the malt liquor measure has been 282 inches to the gallon, and the wine measure 231.

7,000 grains of water, thermometer 62 degrees, and barometer 30 inches, are 1 pound avoirdupois.

The French gramme is 15.434 English grains.

The smaller French weights are in tenths, decreasing, as deci, centi, and milli grammes.

The larger are deca, hecato, chilio, and mirio grammes, in tenths, increasing.

The kilo-gramme, or 1,000 grammes is equal to 2 pounds, 2 ounces, 4 grains avoirdupois.

In Greece, a drachma was 2 pennyweights, 16 grains; a minæ 1 pound, 1½ ounces; a talent 67 pounds, 7 ounces, 6 pennyweights.

The Roman weights were the As, equal to 12 ounces, and the uncia an ounce.

The American quintal is 100 pounds.

The Mysore cutcha seer is 9 ounces, 11½ drachms.

A bale of Egyptian cotton is 90 pounds, of Brazil 160, of Georgian and Sea Islands 280, Orleans 300, East India 300, West India 350 to 400.

A pack of sheep's wool is 240 pounds.

The livre, or French pound, is 500 grammes, or 7,714 grains English, or 1 pound, 1 1-5 ounce. 10 drachms avoirdupois. The quintal, of 100 kilo-grammes, is 220.486 pounds.

The Bengal maund is 74 pounds, 10 ounces, 10⅔ drachms avoirdupois; the seer 1 pound, 13 ounces, 13.866 drachms; the chattock 1 ounce, 13.366 drachms. The Baza maund is 82 pounds, 2 ounces.

A seam of glass is 24 stone of 5 pounds each.

The weight of a cubic inch of distilled water, in a vacuum is 252.722 grains; and in air is 252.456 grains.

The quintal is 10 mirio-grammes, or 2 hundredweight, or 224 pounds, English, nearly.

A sack of wool is 22 stone of 14 pounds, or 308 pounds. In Scotland, it is 24 stone of 16 pounds.

A pack of wool is 17 stone 2 pounds, or a horse load.

A tod of wool is 2 stone of 14 pounds each; and a sack is 13 tod; 12 sacks is a last, or 4,368 pounds.

50 or 60 pounds is a truss of hay, old or new, and 40 pounds a truss of straw; 36 trusses being a load.

A Spanish quintal is 312 Spanish pounds. The arroba is 25 Spanish pounds, of 6,544 grains each; and 5 arrobas make a quintal.

The Portuguese arroba contains 32 Lisbon pounds of 7,005 grains.

The Venetian mirre contains 30 pounds of 4,215 grains.

The shippondt of the northern nations is, in Sweden, for copper 320 pounds, of 9211 grains, and for provisions 400 such pounds. At Riga it is 400 pounds of 6,149 grains. At Hamburgh 300 pounds of 7,315 grains.

100 pounds English is equal to 112⅔ pounds of Russia, to 93 pounds 5 ounces of Hamburgh, and to 132 pounds 11 ounces at Leghorn, and 104 pounds 13 ounces in Portugal, and 91 pounds 8 ounces at Amsterdam.

The commercial pound of Amsterdam is 7,636 grains, and the troy pound equal to 7,602 grains. The Dutch stone is 16 pounds. The Norway pound is 7,833 grains. The Spanish pound is 7,038 grains. The Chinese kin is 5,802 grains, or 375 two-tenths French grammes.

The Turkish pound is 7,578 grains. The Danish 6,941. The Irish 7,774. The Naples 4,962. The Scotch pound troy 7620.8. The Smyrna pound 6944.

The following table shows the weight, in pounds, of a cubic foot, of the following substances:

Name.	Pounds.
Loose earth or sand	95
Common soil	124
Strong soil	127
Clay	135
Clay and stones	160
Mason's work	205
Distilled water	62.5
Pure gold	1203.625
Pure silver	654.8
Cast iron	450.45
Steel	489.8
Lead	709.5
Platina	1218.75
Copper	486.75
Cork	15
Portland stone	157.5
Tallow	59
Oak	73.15
Brick	125
Crown glass	180.76
Fir	34.375
Mahogany	66.4
Air	0.0753

MEASURES OF LENGTH.

Measures in length are the distance of one object from another in some agreed standard.

A line is the tenth of a digit, and the 100th of a foot.

A digit measure is three-fourths of an inch, or 4 barleycorns laid breadthways.

A hair's breadth is the 48th of an inch.

A barleycorn is .00217th of a cubic inch, or about 460 make a cubic inch, or 3 to an inch in length.

A geometrical pace is 4.4 feet English, and an English mile contains 1,200, or 1,760 yards, or 5,280 feet.

The Paris foot is 9 lines shorter than the English foot, or 0.91 to 1.

The Roman foot was 0.915.

The Rhineland or Leyden foot is 0.86925 English.

A Scotch mile contains 1,500 paces.

A German mile 4,000. A Swedish and Danish mile 5,000. The Russian mile 750 paces.

A great league in France is 3,000 paces, and a mean league 2,500.

A nautical league is one-twentieth of a degree.

A hand used for horses is 4 inches.

A degree of latitude is 69 one-seventh English miles at the equator.

A nail's breadth is the 16th of a yard, or 2¼ inches.

A surveyor's chain is 4 poles, or 66 feet, divided into 100 links of 7.92 inches. A square chain is 16 poles, and 10 square chains are an acre.

640 acres are a square mile; and 4,840 square yards are an acre, 169.58 yards each way.

The Irish acre 7,840 square yards.

A French arpent five-sixths of an English acre.

The Scotch acre 1.27 English.

121 Irish acres are equal to 196 English.

48 Scotch acres are equal to 61 English.

11 Irish miles are equal to 14 English.

80 Scotch miles are equal to 91 English.

The Turkish dreah, or pik, is 3 palmi, or 26.41 inches, and the lesser pik is 19.03 inches.

The jaghire is 10.46 English inches. A cawney is rather more than an acre.

A hide of land was one plow's work.

An ox-gang is 15 acres, or as much as an ox can plow in a year.

The long-line adopted in the navy is 48 feet.

A sea league is 3.4536 miles, or the 20th of a degree.

6,078 feet are a sea mile.

A palm is 3 inches. A fathom 6 feet.

The French metre is 36.9413 French inches, or 39.371 English, or 3.2389 feet.

In Greece, a digit was three-fourths of an inch, a cubit 13½ inches, and a large cubit 18⅛ inches; a pace 2 yards and ½ an inch, a stadium 201 yards 1 foot 3 and two-fifths inches; 8 and two-thirds stadia a mile nearly. The plethron, 10,000 square feet.

A Bengal cosa is 6 000 feet, or 1 mile 240 yards.

The haut or cubit is 18 inches.

A baggah of land is 1,600 square yards, about a third of an acre.

A span was 10.944 inches.

Ezekiel's reed was 10 feet, 11 and one-third inches.

A Sabbath day's journey was 1,155 yards or about two-thirds of a mile. A day's journey was 33¼ miles.

The Egyptian cubit, or ardub, was 21.888 inches.

The Greek foot was 12½ inches.

The Hebrew foot was 1.212 English feet. The Hebrew cubit 1.817; the sacred cubit 2 English feet; and the great cubit 11 English feet.

The stadium, 625 feet; and the milliarium, 5,000 feet.

The Amsterdam foot is .927; and the ell 2.233.

The Berlin foot .992.

The Bologna foot .125.

The Brabant ell 2.268.

The Brussels foot .95.

The Chinese imperial foot 1.05.

The Chinese lia is 629 yards.

The Turkish foot is 1.165.

The Florence foot .995.

The Geneva foot 1.919.

The Hamburgh foot .933.

The Italian mile 5.299 feet.

The Portuguese foot .952.

The Madrid foot .915.

The Moscow foot .928.

The Neapolitan mile, four German miles, or one-sixtieth of a degree.

The Roman palm .733. The Roman foot .966.

The Roman mile one seventy-fifth of a degree.

The geographical or Italian mile is 1,000 geometrical paces, or five-sixths of an English mile.

The Roman braccio is four palms.

The canna eight palms.

The Russian werst is 3,508 English feet, about two-thirds of a mile.

The Scotch ell is 37 2-10 inches.

The Scotch mile 5,952 feet.

The Spanish league 4 miles English.

The Swedish foot 1.073 English feet.

The Venice foot 1.14.

The Venice ell 2.089.

The Vienna foot 1.036.

The Vienna post mile 24.888.

The Wirtemburg foot 11.28.

The Levant pig is three-fifths of the French ell. The Venetian ell is eight-fifteenths of the French ell.

The candi, of India, is equal to the Venetian ell. In Siam, the ken is 36 inches nearly, and is divided into 2 soks; these into 2 keubs; and each keub into 12 nions, at ¾ of an inch.

3 inches is a palm; 3 palms, or 9 inches, a span. 5 feet is a pace. 2 yards is a fathom.

The German mile is the 15th of a degree of latitude, or more than 4½ miles English.

A league is 3 sea miles. 17 Spanish leagues is a degree, or about 4 miles, which is the Dutch and German league. The Persian league, or parasang, is 30 stadia or furlongs.

The Paris line .0888.

The Paris ell is 43.9 inches.

The French toise 6 feet 4.733 inches.

The French league 1-25 of a degree.

The French metre 39.37079 inches. The metre is 443.2959 lines, and .513074 of a French toise. Eight chiliometres is about 5 miles English. 1,000 feet is nearly 305 metres.

The metre is the ten millionth part of the quadrant of the earth from the equator to the north pole. It differs slightly from the length of a pendulum which, in the latitude of London, vibrates seconds in a vacuum, at the level of the sea, where it is 39.1393 inches; therefore, the metre is only .23 of an inch longer than our pendulum.

The millimetre, or thousandth part, .03937 inches English.

The centimetre .39371.

The decimetre 3.93708.

The decametre is 10 times the metre.

The hecatometre 100 times.

The chiliometre 1,000 times; and the myriametre 10,000 times.

The area is 3.95 English perches.

An inch English is 2.54 centimetres; a yard is 0.91438 metres; and a mile is 1609.3149 metres.

The French metre is the ten millionth of a quadrant of the earth, taken as 6217.857 English miles, or 32,809.167 feet, and a mean degree of latitude at 69.0429. A centesimal degree is 54 minutes. A league at 25 to a degree is 2.7617 miles. A post league 2,000 toises, or 2.3 miles English; a toise being 6 feet 6¾ inches English. The pied one-sixth of the toise; and the aune 3 feet 11¼ inches English.

A degree at the equator is 365,101 feet, or 69.148 miles, or 69 1-7 nearly. In latitude 66.20 Maupertius measured a degree of latitude, in 1737, and made it 69.403; and Swanberg, in 1803, made it 69.292. At the equator, in 1744, four astronomers made it 68.732; and Lambton, in latitude 12, 68 743. Mudge, in England, makes it 69.148. Cassini, in France, in 1718 and 1740, made it 69.12, and Biot 68.769: while a recent measure in Spain makes it but 68.63, less than at the equator; and contradicts all the others proving the earth to be a prolate spheroid, which was the opinion of Cassini, Bernouilli, Euler, and others, while it has more generally been regarded as an oblate spheroid.

Degrees of longitude are to each other in length, as the cosines of their latitudes. Longitudinal lines run from north to south; latitude from east to west. For every 10° they are as follows:

Equator	69.2
10°	68.15
20	65.27
30	59.93
40	53.1
50	44.48
55	39 69
60	24.6
70	23.67
80	12.02

The diameter of the equatorial circle is 41,837,494.8 feet, and its circumference 131,436,444 feet, which, in a sidereal day, gives a velocity of 1,525 feet per second of rotation.

Then 1,525 × 4=6100 for the velocity of the surface of the whole sphere, which+16.08728, the mean force per second, gives 98.132 feet per second for the orbit velocity of the earth; and this multiplied by 31,558,151 seconds in a sidereal year, gives a mean orbit of 586,527,362.6 miles; and a mean radius, or distance from the earth to the sun, of 93,348,800 miles. The aphelion distance is 94,918,500 miles, and the perihelion 91 779,000.

The pendulum which vibrates seconds 39.1393 inches at London, is the standard for the British measures. One mile is equal to 1618.833 such pendulums.

MEASURES OF TIME.

Time is best defined as the succession of motion and phenomena, independent of relative human perceptions. Time is measured by man by the impressions of successive ideas, and these diminish in a ratio of their own increase; consequently, time appears less as men advance in age, or are variously employed. At ten, a year seems to be twice as long as at twenty; three times as at thirty; four times less at forty; five times at fifty; and six times at sixty; circumstances of employment and position being the same. Hence a month employed in traveling seems equal to three of usual pursuits. Time being mentally measured by the impressions of new ideas. Absolute time, independent of the feelings of individuals, is measured by certain regular motions, as the rotation of the earth, the swing of a pendulum, the fall of a body, the revolutions of the moon round the earth, or the earth round the sun. The tropical year is 365 days 5 hours 48 minutes 51.6 seconds; but the sidereal year, or return to the same star, is 365 days 6 hours 9 minutes 11 seconds; but as the line of apsides or aphelion point advances 655 seconds, the orbit is completed in 365 days 6 hours 15 minutes 20 seconds, and this is called the anomalistic year. The Chaldeans made the sidereal year 365 days 6 hours 14 minutes, or one minute 49 seconds more than our present year, and the tropical year 365 days 5 hours 49 minutes 30 seconds, being 38 minutes 4 seconds more than ours. If Hypparchus was right in his measure of the tropical year, it is 11.2 seconds less than in his time. The Brahmins made it 1 minute 43 seconds more than now.

The precession of the equinoxes is performed in 25,868 years; and the revolution of the line of apsides is 20,931, or 1 degree, 43 minutes, 10 seconds in a century. The precession of the equinoxes is 50 minutes 25 seconds per annum, or 1 degree 52 minutes 45 seconds in a century, or the 360 degrees in 25,868 years. Leap year is the year which divides evenly by four; but the year 1900 will not be leap year, to make up for the odd minutes gained between the astronomical and computed year, as 365 days. The astronomical equinoxes are on the 21st of March and the 21st of September, and the sun is in the tropics on the 21st of December or June. Quarter days in civil reckoning are March 25, June 24, September 29, and December 25, being festivals of the Catholic Church. The Synodical lunar month of her departure from the sun's center to the return, or from full to full, is 29 days 12 hours 44 minutes 12 seconds, and was the universal month of the ancients, twelve being accounted a year. The difference between the solar and lunar year is nearly eleven days. The sun and moon return invariably to the same relative positions every 223 lunations; according to the ancient Chaldeans in 6585 days 8 hours. Our modern tables make it 17.29 seconds less. The Eastern nations, where the day varies little, reckon the day from sunrise. The Romans reckoned as we do, from midnight. Christian nations assign thirty days to April, June, September, and November, thirty-one to other months, and twenty-eight to February, making three hundred and sixty-five; but three hundred and sixty-six in Leap-year, when February is twenty-nine. The Romans added the day in Leap-year on the sixth of the calends of March, making two-sixths or *bis sextus*, and hence the word Bissextile. The astronomical day is the time which elapses from the sun's being on the meridian of a place till his return, divided into twenty-four hours of sixty minutes. And astronomers begin the day at the departure of the sun from the meridian of the place, counting twelve hours till midnight, p.m. or after; and twelve hours from midnight till noon a.m. or before; their day after twelve at night being a day later than civil reckoning, which begins a new day at twelve at night, and reckons from twelve at night to twelve the next night. As the earth advances in its orbit 61 minutes 9.9 seconds, when in its perihelion, and only 57 minutes 10.7 seconds, when in its aphelion, while it returns the same meridian to the sun, that meridian arrives at the same fixed star in twenty-three hours 56 minutes 41 seconds or 3 minutes 6.59 seconds less; others make it twenty-three hours 56 minutes 34 seconds or 3 minutes 56.6 seconds less. Sidereal days are always the same, and accord with a true clock; but owing to the unequal velocity, as expressed, of the earth in its orbit in the perihelion and aphelion, the sun's return to the meridian varies; and also as the earth's path is inclined to the axis of rotation, the solar days vary. Owing to the first cause, the extreme difference is 7 minutes 39 seconds on March 21, and 6 minutes 5 seconds on May 6; 0 on July 1, making the sun slower than the clock; but owing to the obliquity it is 0 on March 21; 9 minutes 53 seconds on May 6th, and 0 June 22, making the sun faster than the clock. The combination of both causes produces the table of equation of time by which true clocks ought to be kept faster or slower than the meridian sun or a sun dial, called apparent time, and the other true or mean time. As the earth moves forward in its orbit 59 minutes 8.3 seconds, while it turns on its axis, any place arrives at a fixed star 3 minutes 56.6 seconds, before it arrives again at the center of the sun, called twenty-four hours; hence the sidereal day is but 24 hours 56 minutes 3.4 seconds, which is the real period of revolution. Hence, in 365 solar days, the earth turns 366 times on its axis, and by this exact quantity it gains in its orbit with reference to the sun and stars in every revolution, and hence the procession of the equinoxes. For as the orbit is caused by the sun, and the equinoxes have reference to the sun and not to the stars, so the equinoxes fall back 24,890 miles, or in space 50.30 seconds with reference to the stars. Every other body like the earth turns once on its axis by going round a central body, and this, therefore, is the sole cause of the equinoxial points. The Chaldeans, Egyptians, and Jews, began their civil year from the autumnal equinox. The Persians, Greeks, Romans, and the English till 1752, began the year at the vernal equinox. Thence to make dates agree with those of other nations, between January and Lady-day, writers used to put two dates, as Feb. 10, $\frac{1708}{1709}$ The bottom date being from January 1, and the upper that from the previous Lady-day. Sidereal days are always 23 hours 56 minutes 3.4 seconds; but as the axis of the earth is inclined to the orbit, and the earth moves faster in the winter than in the summer the clocks which measure equal time do not agree with the sun. A clock and a sun dial will, therefore, vary as follows: March 21, clock too fast 7 minutes 35 seconds; April 6. do. 2.55 seconds; April 20, June 13, September 5, December 25, they are equal. When the sun is in Libra and Scorpio, or in October and November, the difference is from ten minutes to 16 minutes 18 seconds, and the clock ought to be so much faster than the dial. The difference of velocity makes the dial faster than the clock, while the earth is moving from its perihelion on January 1, to the aphelion July 1; and on the contrary, the dial is slower from July 1 to January 1. But the obliquity makes the dial faster from March 21 to June 22; and from September 22 to December 21, and slower from June 22 to September 22, and from December 21 to March 21. The union of both produces the common equation table, page 39, showing to the nearest minute how much a true clock should be faster or slower than the sun. The pendulum for true and exact measuring of time was a suggestion of Galileo, in consequence of his observing the oscillations of a chandelier. Every oscillation, whether long or short, of the same pendulum, is performed in the same time. A pendulum which vibrates seconds at London ought to be 39.139 inches nearly, and the length of pendulums for less or greater times is as the square of time. In India a day is divided into 60 Ghurries, a Ghurry into 60 Puls, a Pul into 60 Prans, and a Pran into 10 Tas, in 2-5ths of a second. The beats in an hour of a common second's clock are 3,600, and 17,280 a common watch; but second watches beat 18,000 times, or 5 per second. A luminous point to produce a visual circle must go round seven times in a second. Fewer than 30 vibrations in a second give no sound, and when the vibrations exceed 7,520 in a second the tones cease to be discriminated. 10 beats of a healthy pulse is equal to 9 seconds. The Roman lustra were periods of 5 years; and the Greek olympiads periods of 4 years; and the first commenced in 776 B. C. The Metonick cycle was 19 years, intended to be equivalent to the Chaldean period. It was afterward adopted as the golden number for Easter. The Hegira, or Flight, took place July 16, 622, and is the Mahomedan Era. Their year is 12 lunar months, or 354 days 8 hours 48 minutes; and 11 days being lost, a year must be allowed every 33, to reconcile their dates with ours. The periodical month of the Turks and Arabs, or sidereal period of the Moon is 27 days 7 hours 43 minutes 48 seconds. The synodical month, or return to the conjunction of the Sun is 29 days 12 hours 44 minutes 3 seconds 11 thirds. The Jews began the year in March, and the months were Nisan, Zif, Sivan, Tammuz, Ab, Elul, Tisri, Bul. Cisleu, Tibeth, Shebat, Adar. The Sabbath, or seventh day is Saturday. The days and nights, from sunrise to sunset, were divided into twelve equal parts or hours, 1, 2, 3, etc. The night watches were three hours each, from sunset to sunrise. The months were lunar, or 30 days and 29 days, and they introduced an extra month every two or three years. The day commences and ends at sunset. The Jewish months were alternately 29 and 30 days, and their year of twelve lunations 354 days. Their year commences with the vernal equinox. To recover the four days they intercalcate a whole month after every two or three years, following their twelfth month, or Adar; and they call this extra month, ve-adar. The Jewish day commences at six in the evening, or sunset, and continues till the same hour on the following evening. Their civil year commences with the new moon near the vernal equinox, in the month called Tisri, of 30 days, corresponding with part of September and part of October. The year 1829 was the Jewish year 5589, and ended September 27, beginning September 9, 1828.

Months.	Days.	Equ. in Minutes.		Months.	Days.	Equ. in Minutes.	
January	1	4	Clock faster than the Sun.	August	9	5	Clock faster.
"	3	5		"	15	4	
"	5	6		"	20	3	
"	7	7		"	24	2	
"	9	8		"	28	1	
"	12	9		"	31	0	
"	15	10		September	3	1	Clock slower than the Sun.
"	18	11		"	6	2	
"	21	12		"	9	3	
"	25	13		"	12	4	
"	31	14		"	15	5	
February	10	15		"	18	6	
"	21	14		"	21	7	
"	27	13		"	24	8	
March	4	12		"	27	9	
"	8	11		"	30	10	
"	12	10		October	3	11	
"	15	9		"	6	12	
"	19	8		"	10	13	
"	22	7		"	14	14	
"	25	6		"	19	15	
"	28	5	Clock faster.	"	27	16	
April	1	4		November	15	15	Clock slower than the Sun.
"	4	3		"	20	14	
"	7	2		"	24	13	
"	11	1		"	27	12	
"	15	0		"	30	11	
"	19	1	Clock slower.	December	2	10	
"	24	2		"	5	9	
"	30	3		"	7	8	
May	13	4		"	9	7	
"	29	3		"	11	6	
June	5	2		"	13	5	
"	10	1		"	16	4	
"	15	0		"	18	3	
"	20	1	Clock faster.	"	20	2	
"	25	2		"	22	1	
"	29	3		"	24	0	
July	5	4		"	26	1	Faster
"	11	5		"	28	2	
"	28	6		"	30	3	

The Mahometan year in 1829 was 1244, and ended July 2, beginning July 14. The Persians gave names to every day in the month, just as we give them to days of the week. Saturday, the 7th day, is, by the Arabs, called Subt. And Monday is called Jama, in all the Eastern languages. Law proceedings preserve the Roman names of the days, as Dies Solus, Lunæ, Martis, Mercurli, Jovis, Veneris, and Saturni, derived from the Roman deities. But in ordinary use, the names are derived from the Saxon or Teutonic deities, the Sun, Moon, Tuesco. Woden, Thor, Friga, and Saturn. The months, or lunar periods, are Roman; and September, October, November, and December were so called when the Roman year began in March. April is so called from Aperit, the spring. As the orbits of the planets complete their seasons, their periods are taken to be their years; hence Mercury has nearly 4 years in ours; Venus two-thirds; Mars is nearly 4 times as long; Jupiter 12 times; Saturn 30; Herschel 83; and more distant planets longer. September, etc., were the 7th, etc. month of the year of Romulus. From the spring to the summer solstice is 92 days 21 hours 45 minutes. From the summer to the autumnal equinox, 93 days 13 hours 35 minutes, northern signs. From the autumnal to the winter solstice, 89 days 16 hours 47 minutes. From the winter to the spring equinox, 89 days 1 hour 42 minutes. Southern signs.

MEAT. The growth of the live and dead meat trade, the facilities for shipping and preserving it fresh during long voyages, whether canned or simply in the quarters, is one of the wonders of modern civilization. Improved processes in the curing of salted meats is also as wonderful as it is interesting. The packing, preservation, and shipping of meats at all our great packing centers, is now carried forward continuously winter and summer, and on a scale of magnitude, astonishing to those who witness it for the first time. The patents for preserving meats are various and numerous. Of over 100 processes, twenty-six are for preserving by drying, thirty-one by excluding atmospheric air, nine by covering with an impervious medium, as collodion, fat, gelatine, paraffine, etc., and seven by injecting with various salts. Freezing in bulk, and keeping the meat frozen by means of ice until it arrives at its ultimate destination, salting and barreling, salting and smoking, salting and drying, and canning are the only plans yet found, that give entire satisfaction combining, as they do, cheapness with integrity of quality. In 1871, the total export of meat and meat products, was in value as follows:

Live animals and fowls	$ 1,019,604
Pork	4,302,330
Hams and bacon	8,126,683
Beef	3,825,666
Preserved meats	208,362
	$17,492,645

In 1877 our meat exports were as follows:

Live animals	$ 3,325,203
Pork and pork products	81,653,042
Fresh beef	4,552,523
Salt beef	2,950,952
Total	$92,481,720

In 1878 our live stock exports amounted to $5,845,157; our hog products to $87,674,419: fresh beef, $5,009,856; and salt beef to $2,973,234. These exports went principally to Great Britain, France, and other European States and the West Indies. Since that time our exports, especially of live and dead animals, have continued to increase. For the year ending March 1, 1880, the exports of live stock was of the value of $12,065,459, and of other food products, $374,568,342. For the year ending March 1, 1881, the export of live stock was of the value of $20,681,738, and other food products was exported to the value of $456,244,111. Early in the year 1881, certain interested persons in Great Britain, got up a scare on Trichina in swine, and representations to the governments of Great Britain and France, resulted in an embargo upon the importation of hog products into France, and to the taking of strong ground by Great Britain. Almost before action was taken by the French government, the French Academy, showed the fallacy of the action, demonstrating that the single individual poisoned, was so by eating pork, born and killed on French soil. (See Trichina).

MECHANICAL COLLEGES. (See Agricultural Colleges.)

MECHANICAL POWERS. The simple machines, the lever, pulley, wheel and axle, wedge, and screw.

MECHOACAN. *Convolvulus panduratus.* Wild potato vine. A perennial, herbaceous bindweed, with tuberous root, of a slightly cathartic property.

MECONIC ACID. The acid with which morphia is combined. It is tribasic, white, crystalline, acid, and soluble in water and alcohol; the solution turns red when a per salt of iron is introduced into it. Comenic and pyro-meconic acids are derivatives.

MECONIUM. Once applied as the name of opium; now, only used to designate the excrement to be found in the intestines of all new-born animals.

MEDIASTENUM. The portion of the cavity of the chest made by the folding of its membrane (pleura).

MEDIC. The genus Medicago. The principal species is *M. sativa,* lucerne. (See Alfalfa.)

MEDIUM. In science, the substance in which any body is immersed. It is called rare, dense, opaque, or transparent, according to its nature. It causes resistance to motion, and, more especially, acts upon the passage of light, bending (refracting), it from its straight course. Astronomers are disposed to admit the existence of a very rare medium or ether beyond the earth's atmosphere, filling the space of our solar system.

MEDULLA or MEDULLIN. In botany, that tissue which constitutes the pith of certain plants, as the pith of the sunflower. Medullary rays are the vertical plates of cellular tissue, which radiate from the center of the stem of exogenous plants, through the wood to the bark. They cause that appearance in timber which carpenters call silver grain, or flower of the wood. The medullary sheath is a thin layer of vessels, which surround the pulp of exogenous plants, and thence extend into the leaves and parts of fructification.

MEDULLARY SUBSTANCE. The white, internal portions of the brain. Medullary tumors contain a substance of the same appearance.

MEDULLIN. The pith of plants.

MEGRIMS. (See Epilepsy.)

MELASOMES, MELASOMA. A tribe of heteromerous coleoptera, of a black or dark uniform color.

MELASSIC ACID. The product of heat and alkalies on solutions of grape sugar; the acid of molasses.

MELIC GRASS. *Melica.* A genus of perennial, harsh grasses. (See Grasses.)

MELILOT CLOVER. (See Clover.)

MELLIPHAGANS. A family of birds (*Tenuirosters,*) some of which feed on honey.

MELOE. A genus of coleopterous insects. They are remarkable for the blistering power they possess.

MELOLONTHIANS. The family of coleopterans to which the May-beetle or cockchafer belongs, (*Melolontha vulgaris.*)

MELON. All our valuable members of the *cucurbitaceæ,*, belong originally to the East, and to central Asia, but the precise home of no one of them is known certainly, since the native plant of no one species is found growing wild, on account of their cultivation from remote antiquity. The home of the muskmelon is supposed to be the Caucasus, and since the Jews bewailed the loss of the watermelon, during their wanderings in the wilderness, this fruit was certainly cultivated in Egypt, previous to the Exodus. To this day the muskmelon reaches its greatest perfection in Persia, and the pulp of the watermelon furnishes an article of food during its season to the modern Egyptians. The watermelon was carried by the Arabians in their western emigration, and after the discovery of America they were quickly and widely disseminated. The cucumber family, in all its branches, found here a genial climate, and in no country in the world are the whole tribe, including melons, pumpkins, and squashes, so widely cultivated. The best soil, for both the musk and watermelon, is a light, rich sandy loam, but they will grow well on good prairie soil, if well drained, and the lands are ridged up to correspond to the width of the rows at which the hills should be planted, nine feet for watermelons and seven feet for muskmelons. It is an error to suppose that the melon will thrive in a poor soil. Each hill, even on good corn land, should have a half bushel of good compost manure. For field culture, dead furrows may be thrown out at the proper distance for the rows, cross mark the land at equal distances and in the checks, throw half a bushel of rich compost, turn four furrows as deeply as possible over this, cross mark again over the remains of the check rows to designate the hills, with a plow, then plow the balance of the lands; plant plenty of seed, not less than ten or fifteen to each hill. The cultivation is simply to keep the soil clean, many throwing earth always to the plants until the vines render plowing no longer possible. When the plants are out of the way of the cut worms and striped beetles, thin the plants to three in a hill. If the land gets weedy, after the vines run so as to interfere, turn them back with the handle of a hay rake, cultivate the balks, turn the vines back again, and so proceed until the field is finished. It should be unnecessary to say that both watermelons and muskmelons are among the most healthy, as they are the most grateful of fruits, if ripe and eaten fresh from the vines, and particularly unhealthy if green or stale. There is no reason why every farmer should not raise an abundance of these fruits, since their cultivation is precisely like that of the pumpkin and squash. Indeed, we have grown very good late melons among Indian corn, as it is not uncommon with pumpkins.

MEMBRANE. The tissue or expansion of animal or vegetable matter surrounding the bones, and lining cavities. That lining the intestinal and urinary apparatus is mucous. The fibrous membrane covers all the bones and many muscles; and the serous tissue exists on the outer surface of the lungs and intestines, etc.

MENINGES. The membranes which cover the brain.

MENISCUS. A lens, concave on one side and convex on the other.

MENSTRUUM. Any fluid which dissolves a given solid.

MENSURATION. The admeasurement of the contents of solids or areas of surfaces.

MENTUM. The chin. The lower and anterior portion of the under jaw of animals.

MEPHITIS. A noxious vapor; hence mephitic.

MERCURY. Quicksilver, fluid, white, brilliant; it freezes at 40°; boils at 660°, rising in vapor unchanged. It is soluble in nitric acid, and the oxides combine with numerous acids. Calomel is a chloride of mercury; corrosive sublimate, a bi-chloride is one of the most fatal poisons.

MERE. A pool, lake, or pond.

MERIDIAN. A great circle passing through the zenith of any place and the north and south pole, on which the sun comes at 12 o'clock. The magnetic needle lies nearly in the meridian, the departure from this line being called its variation east or west.

MERINO SHEEP. (See Fine-wooled Sheep.)

MESENTERY. The membrane which binds the small intestines to the backbone; it is a fold of the peritoneum, and contains the vessels, nerves, and absorbents, going to or from the bowels.

MESLIN. In Spain, a union of flocks; more commonly a mixture of seeds sown together, as wheat and rye, oats and peas, etc.

MESO. An affix to many compound words, meaning the middle.

MESOCOLON. The membrane surrounding the colon.

MESOPHYL. The central layer of the leaf; we have also mesocarp, the fleshy part of the fruit.

MESOTHORAX. In entomology, the posterior segment of the thorax, bearing the second pair of wings and third pair of legs.

MESOTYPE. The silicate of alumina and soda; it occurs in trap and ancient lavas.

MESTA. A mixture of flocks.

META. A prefix to many compound words.

METABOLIANS. Insects which undergo complete metamorphosis.

METACARPAL. That portion of the hand between the fingers and wrist; metatarsal is the same part in the foot.

METAGALLIC ACID. Gallic acid changed by heat.

METALLOID. Potassium, sodium, and other alkaline metals; it is sometimes applied to the inflammable elements, as sulphur, phosphorus.

METALS. Elementary bodies, remarkable for their luster; they conduct electricity and heat, and are negative electrics. Of the peculiarities of some of the metals, Appleton's New Cyclopædia says: The peculiar brilliancy and reflective power of the metals, which may be enhanced by polishing, results from their great opacity. The color of the metals is generally white with a grayish, bluish, or pinkish tint; copper and gold are the only exceptions. In extremely thin films some of the metals allow the passage of certain rays of light. Gold leaf transmits light of a faint greenish hue. Most of the metals have a high specific gravity, a property which was regarded as characteristic until the discovery of the alkaline metals, which are lighter than water. With the exception of arsenic, they may all be fused, the temperature required for fusion varying from 100° F. to the highest heat of the oxy-hydrogen blowpipe. Some of the metals may be volatilized. Mercury, the only liquid metal, is solidified at—39° F. Arsenic when heated passes directly into vapor without fusion. Most of the metals possess a certain mobility of particles that allows of their being extended or otherwise altered in form. The two nearly related properties of malleability and ductility, resulting from this, are not possessed by the metals in the same degree. A few of them, as antimony, arsenic, and bismuth, are decidedly brittle. Some assume a plastic condition before complete fusion, notably iron and platinum; on this property depends the operation of welding. The strength of the metals is very dissimilar, iron in the form of wire being about twenty-six times as tenacious as lead. They are all conductors of heat and electricity, although differing widely in this respect. The following table gives their names, specific gravity, and melting points:

Names of Metals.	Specific Gravity.	Melting Points.
		Fahrenheit.
1. Gold	19.25	2016°
2. Silver	10.47	1873
3. Iron	7.78	2800? Smith's forge.
4. Copper	8.89	1996
5. Mercury	13.58	—39
8. Lead	11.35	612
7. Tin	7.29	442
8. Antimony	6.70	....
9. Bismuth	9.80	497
10. Zinc	7.00	773
11. Arsenic	5.88	....
12. Cobalt	8.53	2810?
13. Platinum	20.98	oxyhydrogen blowpipe.
14. Nickel	8.27	2810?
15. Manganese	8.65	Smith's forge.
16. Tungsten	17.60	....
17. Tellurium	6.11	820?
18. Molybdenum	7.40	oxyhydrogen blowpipe.
19. Uranium	9.00	
20. Titanium	5.30	
21. Chromium	....	
22. Columbium	....	
23. Palladium	11.50	
24. Rhodium	....	
25. Iridium	....	
26. Osmium	....	
27. Cerium	....	....
28. Potassium	0.86	136
29. Sodium	0.97	190
30. Barium	....	....
31. Strontium	....	....
32. Calcium	....	....
33. Cadmium	8.60	442
34. Lithium	....	....
35. Silicium	....	....
36. Zirconium	....	....
37. Aluminum	....	....
38. Glucinum	....	....
39. Yttrium	....	....
40. Thorium	....	....
41. Magnesium	....	....
42. Vanadium	....	....

METAMORPHOSIS. Transformation. In entomology, the changes the metabolian insects pass through of larva, pupa, and imago. In botany, the doctrine that the flowers, stamens, carpels, and seeds are modifications of the leaf.

METASTASIS. The change of an affection or pain from one part of the body to another.

METAYER. A farmer who rents land at a certain proportion of the crop, usually half, the owner finding tools and animals.

METEOROLOGY. (See Atmosphere, Climate, Dew, Earth, Electricity, Rain, Soil, etc.)

METEORITE, AEROLITE. Masses of metallic matter occasionally precipitated to the earth.

METEORS. Transitory phenomena occurring in the air; aerial meteors are winds, tornadoes, etc., aqueous meteors are rains, hail, fogs; luminous meteors are halos, rainbows, lightning, northern lights.

METHEGLIN. Metheglin, or mead made of honey, has been known since the remotest times.

Long after the introduction of wine, and even beer, it was the national drink of the English, as beer is to this nation and the Germans now. It is one of the most healthful, moderately used, of any of the fermented spirituous liquors, and as insidious as it is seductive, if immoderately used. A story is told of a British officer soon after the Revolutionary war, who, visiting this country, was made drunk on metheglin. He journeyed from New York to Philadelphia through New Jersey, famous then for its metheglin as it has since become for its cider, remained in Philadelphia a week, and returned to New York declaring that it took him a week to get well drunken on the honey wine, and, on my honor, he added, I think it will take me a year to get sober. To make metheglin the sweet or honey water obtained from the operation of purifying or clarifying the honey is boiled in a kettle and repeatedly skimmed off. The boiling continues until the mass has attained such a consistency as to bear a hen's egg, with its point reaching out of the liquid. If there is not honey water enough, or if none at all, mix honey and water, the honey being one-fourth to one-third of the weight of the water. After it is sufficiently boiled, cool it off, put it into a cask so as to fill it nearly full; then bring the cask into a place of from 54° to 59° Fahr., covered with a cloth, and allow it to ferment. After six weeks, and in warm countries much sooner, filter it through blotting paper and put it into small casks. What remains may be filled into bottles, which are closed, but not tight, with a rag, and put away in a cool place. The fermentation also continues in this second cask, which is but lightly closed with a bung covered with a cloth. The mass in the cask is gradually reduced by fermentation, so that what remained in the bottles can now be added. After nine or ten months the metheglin is again put into another cask, with the bung driven in tightly and the cask set in some cool place. When completely fermented a healthy beverage is obtained, that bottled quite air-tight will keep for a long time and continually improves. Another notable drink is honey wine. Boil slightly thirty pounds of honey and sixty quarts or fifteen gallons of water for two hours, skim and cool it off and treat it like metheglin, except that a nutmeg and one ounce of coarsely-ground cinnamon are put into a linen or cotton bag, and inserted in the bung hole, and thus kept suspended in order to impart an aromatic flavor to the wine. This beverage, similar to the Spanish grape wine, but excelling it in quality, invigorates the stomach, promotes digestion, purifies the blood, and is very beneficial to the chest. There is another kind of honey wine, which, by being kept bottled a few years, will equal the best Madeira, and form a most delicious beverage, though it is somewhat troublesome to prepare it. Mix forty pounds of honey with eighty quarts or twenty gallons of running water, put it into a clean kettle, gently boil it and skim it. After thirty minutes gradually add five pounds of finely-ground chalk, continually stirring the mass. Skim off the tough substance which gathers at the top of the kettle until no more of it appears on the surface, then pour the mass into a vessel, allowing it to subside and cool, so that the chalk may settle. Let the kettle in the meanwhile be thoroughly cleansed of the chalk remaining in it, and the mass carefully poured back again into the kettle, with an addition of nine pounds of finely pulverized charcoal, and then gently boil the whole for two hours. Put the liquid again in a clean vessel to cool off a second time, after which filter it through a pointed bag of felt or flannel. After this pour the liquid once more into a kettle and heat it up to the boiling point. Then take the whites of thirty-five eggs, mix them with water, stirring the whole until a foam appears, and add it gradually to the other mixture. The liquid is perfectly clarified by the addition of this foam, which takes off the particles of charcoal that may have remained, together with other impurities. The chalk removes the acid taste, and the charcoal that of wax. The liquid, after the whites of eggs has been added, is gently boiled another hour, allowed to cool down, and then filled into a cask having a small space empty about the bung hole, which is lightly covered with a piece of linen so as to permit the mass to ferment. The additional treatment is the same as before given. Clarified in the cask and bottled, this wine will keep for an age. Cool cellars of from 38° to 41° Fahr., are, of course, a main requisite. The bottles are to be laid in wet sand, on which salt water is occasionally poured. Metheglin, even when young and not yet possessing much vigor or spirit, will make a pleasant beverage mixed with tart, especially red wines. All tart wines, in general, can thus be made agreeable and thoroughly improved.

METHOL. A hydrocarbon, obtained by distilling xylite with sulphuric acid.

METHYL. A volatile, combustible spirit, soluble in water, closely resembling alcohol. Numerous compounds of methyl are known.

MEXICAN TEA. (See Goosefoot.)

MEZEREON. *Daphne mezereum.* A highly ornamental shrub with pink flowers. The spurge laurel; the whole plant is poisonous. It is readily cultivated, although exotic.

MEZZANINE. In architecture, a low story introduced between two taller ones.

MIASM. Malaria, infectious vapors from marshes, etc. Malarial districts are especially deadly at night.

MICA. A bright laminated mineral of every color, elastic, and more or less transparent. An ingredient in granite and most ancient rocks, often occurring in large sheets, and used as a substitute for glass.

MICA SLATE. A transition slate, full of bright specks of mica mixed with quartz.

MICROMETER. An instrument affixed to microscopes and telescopes for measuring the size of objects.

MICROPYLE. In botany, a small hole over the apex of the nucleus of a seed.

MICROSCOPE. An optical instrument used to examine objects too minute to be seen by the naked eye. Microscopes are single or compound; a single microscope being one through which, whether it consists of a single lens or a combination of lenses, the object is viewed directly; and a compound microscope one in which two or more lenses are so arranged that an enlarged image of the object formed by one of them is magnified by the second, or by the others, if there are more than two, and seen as if it were the object itself. A magnifying glass is a single microscope.

MIDDLEMEN. (See Marketing.)

MIDDLE RAIL. The central rail of the door, on which the lock is placed.

MIDGE. Minute insects infesting wheat, the gooseberry, and various plants. They are sometimes very destructive to wheat, barley, rye, grass, etc. The eggs are deposited in June and July, in the opening flowers of the grain. These hatch in about eight days, and produce minute, orange-colored grubs, which feed upon the juices of the grain when in a milky state, inside the chaff or outer covering, or upon the pollen of the flower. When fully grown most of the larvæ descend and burrow in the earth, where they remain all winter. The pupæ usually are formed in the ground in May or June; some, however, remain in the heads, and the perfect fly or midge makes its appearance the following season to deposit its eggs on the grain and grass. Lime or ashes, strewn over the grain when in blossom and wet with dew, will be useful. Newly-slaked lime and wood-ashes will be required, in the proportion of a peck to a bushel to the acre. When the maggots have left the grain and are in the ground, plowing is recommended as soon as the grain is harvested. The chaff and refuse-straw together, containing the larvæ or pupæ, should be scalded, burnt, or otherwise destroyed. Early sowing of all wheat in the autumn, or late sowing of spring wheat in the spring, will enable the wheat to become too far advanced, and hard, before the fly makes its appearance in the first case, and by not coming into blossom in the last, until the flies have disappeared. When the midge has been very abundant the previous summer, deep fall plowing has been recommended, and a different crop should be sown next season. Until we find some parasitic fly, like the European species, to aid us in their destruction, there is very little hope of successfully battling with this little pest. In this country a species of thrips is said to destroy the eggs or larvæ; a coccinella or lady-bird feeds upon the larvæ, and the yellow-bird is said to feed upon them. In Europe they are destroyed by several parasitic hymenoptera viz., *Cailimone*, *Macroglenes*, *Platygaster*, etc. The earwig also destroys either the wheat-midge or a thrips which frequents the wheat. The gooseberry-midge (*Cecidomyia* (*Asphondilia*) *grossulariæ*) injures gooseberries by depositing its egg in the fruit, and the larva, or grub, being hatched, feeds inside, and causes the gooseberry to present a prematurely ripe appearance, to turn red, and then drop from the bush. It is recommended to pick all fallen fruit from the ground and burn it immediately, as, although this proceeding may not be of any use the same season, the berries being already destroyed, the following year, the last season's generation being destroyed, there will be scarcely any midges to attack his future crops.

MIDRIB OF A LEAF. The central collection of woody fibers and vessels; the prolongation of the leaf stem.

MIDRIFF. The diaphragm; the muscle which divides the cavity of the chest from the abdomen.

MIGNONETTE. *Reseda odorata.* A plant of the most delicate fragrance and of easy cultivation, but which transplants with difficulty. Therefore it should be sown where it is to stand, or else sown in pots and transplanted with the ball entire. A good plant should be in every window collection in winter. Sow the seed in the pot in which it is to flower in September, and after the seed is up give plenty of heat, but not too much water. Many complain that they lose their mignonette in winter; this is owing to its being kept too damp. It should have little or no water for about three months during the dull season, and care should be taken to keep it from drip, which is sure to kill whatever plant it falls upon. When small pots are used, particular care need not be taken to have the soil very rich, provided it is light; but when sown at once in flowering pots, richer material should be used, draining well, and placing on the top of the crocks, in the bottom of the pots, flaky pieces of decayed manure for the double purpose of affording nourishment to the plant when coming into bloom, and to keep the soil from choking up the drainage. Autumn sown plants shifted into larger pots at Christmas will bloom till May; and another sowing now will succeed them, after which it may be had plentifully; and no amount can be too large in the open ground. Unpromising plants, if topped back about this time, come in nicely for winter boxes in May. Pots of them may be set among stocks, geraniums, or other dwarf plants, the box filled up with rich, light soil, and finished off with a good watering to settle the earth around the roots. Boxes thus arranged are beautiful ornaments for the window-sill; the geraniums or other flowers giving brilliancy and the mignonette fragrance. Tree mignonette, a vigorous plant from the common kind sown in April should be chosen, put into a pot by itself, and all summer the blossom buds to be taken off as fast as they appear. In the autumn the lower side shoots must be taken off, so as to form the plant into a miniature tree. It may afterwards be transplanted into a larger pot with soil formed of sand, and turf broken into small pieces. The plant should be kept in a warm room all winter, regularly watered every day, and in the spring the stem will begin to appear woody. The second summer the same treatment should be observed, and the following spring it will have bark on its trunk and be completely a shrub. It may now be suffered to flower, and its blossoms will be delightfully fragrant; and will be produced every summer for many years.

MIGRATORY. Migrating or moving with the season to the North or South, as numerous birds and fishes.

MILE. 1,760 yards. The sea mile is one-sixtieth of a degree, or 2,025 yards.

MILFOIL. (See Forage Crops.)

MILIARY. Granulated, like many small seeds.

MILK. This wonderfully constituted, natural product of the females of mammalia, produced in the precise proportions as to constituents, for the most perfect assimilation by the systems of young animals is now acknowledged by scientists as being not only a perfect food for infants, but also as being capable of sustaining life perfectly in mature age. In old age it is well known to be one of the most valuable in the whole category of foods. Cow's milk is composed of water, eighty-seven to eighty-eight parts, the twelve to thirteen parts remaining in 100, being fat, (butter,) caseine, (cheese). milk sugar, a substance analagous to glucose, and earthy (mineral) matter. Milk is not only capable of supplying—theoretically—every tissue of the animal body, keeping the whole system in vigor and health, but then there is no waste. The constituents necessary to form bone, muscle, fat, hair, in fact the whole economy of the system, is contained, and in the proper proportions for all growing animals, and again mixed with the proper proportion of water, for perfect digestion and assimilation. Hence, milk warm from the cow, but preferably from the mare or goat has always been regarded as one of the best foods for consumptives, or dyspeptics, that could be given. In wild breeds of animals, the specific gravity of milk, as well as its composition, is pretty constant since each and every animal is constant to a given type. Animals improved by careful crossing, feeding and selection, however, differ very materially in their milk, some breeds, as the Jersey, being especially rich in butter, and others again, as the Ayrshire, and Dutch cows, being rich in cheese. When the lactometer was brought into use—an instrument for testing the specific gravity of milk—it was thought by many that a perfect check had been discovered to the watering of milk, and the courts of New York are said to have come near convicting a man of adulteration on this test. Yet a particular cow may give milk lighter or heavier than the average standard. In fact, as between individual cows, the variation may be ten per cent. So, as we have said before, some breeds will give milk rich in butter, and consequently lighter, while others will give milk rich in cheese, and consequently heavier. So cows fed on watery food will be largely increased in quantity, and from naturally containing an abnormal quantity of water will be heavier than the standard. Nevertheless, the milk of a mixed herd, taken as a whole, will always be uniform. Again, rich food, with a proper quantity of water, will increase the flow of milk up to the point of assimilation by the animal. Poor food will diminish the yield to a minimum. Yet, poor food does not necessarily produce poor milk, only a reduced flow, nor rich food richer milk, but an increased flow. Thus the improved lactometer is the most valuable, as showing the specific gravity of milk. Knowing the gravity of a particular herd, if it vary much, it is pretty conclusive evidence that the milk has been tampered with, and should become a fit subject for analysis. Nevertheless, the lactometer should not be used to convict a man of crime, for there are plenty of means, known to scoundrels, of keeping adulterated milk up to its standard, so far as specific gravity is concerned, and the test by gravity is not a sure test of purity. As to the average quantity of milk given by cows and the cream as between the herd Ayrshires and natives with which he has carefully experimented, Dr. Sturtevant of Massachusetts gives the following data: With reference to the average yield of milk in Massachusetts, (because we wish to get a basis by which we can ascertain the comparative yield of milk,) I find, on looking over the Agriculture of Massachusetts, a record of seventy-six different experiments, carried on by nineteen different people, in Worcester county, during a series of years, by which it appears that it took, on the average, 20.9 pounds of milk to make a pound of butter. In 1864, the statistics of 425 cheese factories in the State of New York gave the proportion of milk to the pound of cheese as 9.11. In the statements, I make, I reduce butter and cheese to the milk valuation by allowing twenty-five pounds of milk for a pound of butter, and nine and one-half pounds of milk for a pound of cheese, which will certainly be fair. I find, then, that according to the census of Massachusetts, in 1865, the amount of milk sold from each cow was 691 quarts. In nine towns in the Hoosac Valley, with 7,480 cows, the average yield, in 1865, was 1,179 quarts per cow. The average premium dairy of seven cows in Essex county, is reported, in 1865, to have given about 1,750 quarts. Another dairy of nine cows, in Danvers, in 1856, is reported to have given about 2,000 quarts per cow. Another gentleman, who feeds daily five quarts of a mixture of rye, corn, and cotton-seed meal to his herd, reports a sale of 2,274 quarts per cow for one year. Another premium herd of six grade Durhams reports 2,460 quarts per year. The only returns of yearly yields of single cows that I find in the Massachusetts Reports are four native cows, four owners, 3,189 quarts per cow, and forty-four native cows, in four herds, 2,160 quarts per cow;—that is the average of the herd, counting all as in milk. These are the records of premium cows and competing herds, with but one exception, and must manifestly be far above the average. I now go outside of the State of Massachusetts, having exhausted all the definite facts that I can find in our Reports, to the State of New York. I will not give the particulars from which I draw my conclusions; I will state it as probable, and have you take it upon trust, that the average yield of dairy cows in the State of New York, is not far from 1,300 quarts. The average of the best dairies in the State, 1,800 quarts. The possible average which can be attained by the best farmers, with their best herds, 2,300 quarts. Here, you will notice, there is a common difference of 500 quarts, between common, best and superior dairies. I speak not of the yield of individual cows, but of the average of a herd of cows. Dr. Sturtevant also relates that, of the purchase of Waushakum Farm by himself and brother, they procured the very best native cows they could find, continually disposing of poor cows and replacing them by better, and breeding in stock. The outcome was as follows: In 1866, with an average of 35.7 cows, we produced 2,160 quarts per cow, on an average. In 1867, with an average of 36.3 cows, the average yield per cow, was 2,229 quarts. In 1868, with an average of 27.4 cows, the average yield per cow was 1,850 quarts. The average yield for the three years, from thirty-three cows, was 2,079 quarts per cow. We then imported some Ayrshire cows, and these with other Ayrshires purchased in this country, comprised our herd for the next three years. As we were now breeding, we had to change our system of feed. A system which would allow us to send a cow to the butcher when injured, would never answer with a breeding herd of valuable animals. In 1870, average number of cows, 19.8; average yield per cow, 2,616 quarts; 1871 average number of cows 18.7; average yield per cow 2,300 quarts. Mr. Miles, of Fitchburg, who makes a very candid and apparently fair record of his herd of 9.3 cows for three years, gives his average as 2,587 quarts per cow per year. In order to bring the matter into the most simple showing, he represents the facts reduced in another form, as given in the table below:

Breed.	Possible Average.	Average of best Dairies.	Common Average.
Natives......	2,300 quarts.	1,800 quarts.	1,300 quarts.
Ayrshires.....	3,000 "	2,500 "	2,000 "

Dr. Sturtevant continues as follows: Here is a common difference of 700 quarts in each class; and if my figures are correct (and I have taken every fact I could obtain, and excluded none), this sum, 700 quarts, may well represent the breed difference of the Ayrshire and native cattle. Consequently, any farmer who exchanges his natives for Ayrshires of the same rank among Ayrshires as his natives are among natives, increases, by this change, the average annual yield of his dairy, per cow, 700 quarts. The milk farmer who is selling his milk at four cents a quart, can increase his annual yield by at least twenty-eight dollars per cow, by replacing natives by Ayrshires of equal grade. It is probable that these same results will apply in a determinable ratio between grade Ayrshires and natives; but I have not yet collected sufficient facts to warrant a definite statement of my own ideas of the value of grade animals. When, through the exertions of the friends of agriculture, and the workers, sufficient facts are published, I shall reserve the right to change these figures. The breed difference is there, and is great. Thus much our present knowledge enables us to state; and according to my present figures, which include every fact I have been able to collect, 700 quarts is this breed difference. I should not lay so much stress upon the records of Waushakum Farm, did I not know that they are perfectly accurate. Similar judgment was exercised in selecting both natives and Ayrshires; similar care, similar ideas of feed, modified only by circumstances, and similar recording of facts; we have here the conditions of a true comparison of breeds. The milk has been weighed daily from each cow on this farm; and I have the recorded weights, with the food each day or month, and other notes of interest, preserved for future reference. As a curious fact, let me add, that of all the cows whose yield for the year I can find given in my Massachusetts Report (I have not the Reports from 1858 and 1862), the average of the four premium native cows is 3,189 quarts; the average of the three Ayrshire crosses per year is 4,673 quarts; the extremes among the native cows are 2,692 quarts, and 3,826 quarts; among the Ayrshire grades, 3,700 quarts, and 6,048 quarts; the average of the best native or grade, six cows, from twenty, for one year, was 2,462 quarts; the average of Waushakum herd of Ayrshires, six selected animals, for one year, was 3,123 quarts. Here, also, we have about 700 quarts, representing the breed difference between Ayrshires and natives. Our practice has been, in selecting any cows, to select the best we can find among a great many individuals, and in selecting our native cows we had our choice among tens of thousands; we had the whole country to choose from; and we selected the very best, in our judgment, that we could find, and paid the largest prices for them; and at the time when good milch cows were selling for from fifty to sixty dollars, we had a standing offer, well known to all the farmers in the region, of $125 for any cow that would milk twenty-six quarts a day. We purchased cows under that plan, and we claim, therefore, that while our comparison of the best cows in each breed is certainly fair, it is yet not quite fair, because in selecting the natives, we had tens of thousands to select from; and in selecting the Ayrshires, we had only a few thousands in Ayrshire, and a thousand or so in this country to select from. So it is a fair comparison, because it takes the best Ayrshire cows and the best native cows and compares them together. We could very easily compare the average Ayrshire cow and the average native cow, provided we had the statistics which would give us the average in each case; but it is fair to presume that in the cases presented to our agricultural fairs, by farmers, each farmer presented the best cow he had, and thought she was a very superior cow. Condensed or desiccated milk is produced in large quantities at Elgin, Ill., the only factory, I believe, in the West. It is condensed by evaporating in a vacuum pan, as it is called, precisely as in the modern mode of finishing the juice of the sugar cane. Dr. Voelcker, of England, has given the following: When milk is evaporated at a low temperature, and a little sugar is added, when the process of evaporation is nearly completed, the residue which is left on final evaporation, on being reduced to powder, constitutes a white powder with a yellow tinge, which dissolves for the greater part in boiling water. The solution resembles in appearance and taste milk, and answers pretty well as a substitute for milk for ships' use, or when fresh milk can not be obtained. Desiccated milk, if well prepared and perfectly dried, may be kept in closed bottles for many months without undergoing any change, but it does not dissolve perfectly in water, and is deficient in the agreeable taste which characterizes good fresh milk. Usually a portion of the cream is removed before the evaporation of the milk, for if the whole milk be condensed by slow evaporation, the desiccated milk is very apt to assume after a short time a bad taste resembling rancid butter. The following are analyses which I made some time ago of two samples of desiccated milk:

	No. 1.	No. 2.
Moisture	4.06	1.78
Fat (pure butter)	8.73	16.32
Caseine	20.25	20.37
(containing nitrogen)	(3.24)	(3.26)
Phosphate of lime and magnesia	2.34	2.33
Alkaline salts	2.48	2.91
(containing phosphoric acid)	(0.26)	(0.31)
Sugar	62.14	56.29
	100.00	100.00

The second sample, it will be seen, contains nearly twice as much fat (pure butter) as the first, which was evidently produced from skim-milk. The sample No. 1 had a nice taste, and, notwithstanding the deficiency of butter, was a superior preparation in comparison with the second sample, which had a disagreeable taste of rancid butter. A much better description of concentrated milk has been prepared for a good many years past in America under Borden's patent, and a few years since an American Company—the Anglo-Swiss Condensed Milk Company—had established a factory at Cham, near Zug, in Switzerland, for the production of pure Swiss preserved milk. This company, with a capital of £12,000, employs about sixty operatives in their factory. The number of cows hired for the year is 1,440, and the average amount of condensed milk prepared daily during each of the 365 days of the year is 110 cases, of four dozen each of one pound cans; these equal 1,927,200 cans as the product of the year. The price of the crude milk is about two pence per quart; and the daily cost of the tins or cans made at this establishment amounts to £16 10s. About one-half of the product is sent direct to London, where one-half is consumed, while the remainder goes for ships' stores, is exported to the colonies, and sent to the provincial towns of England. One-half of the produce not sent to London is distributed over Germany, and there is some demand from France and Russia. The success of the condensing factory depends entirely upon the ability to put a fine flavored, perfect article into the market. The milk must be uniformly good, and a fastidious neatness and cleanliness must be observed in the establishment. The milk is evaporated down in vacuo at a uniform temperature of 160° Fahr., with the addition of the best refined white sugar, until it reaches the consistency of thick syrup or honey. It takes about seven hours to condense the milk, seventy-five per cent. of its original bulk in water being driven off. The condensed milk thus prepared has been preserved in good condition for years. Mixed with three to four pints of water it readily dissolves, yielding a somewhat sweet but agreeably tasting fluid, having a flavor of boiled milk. It consists of nothing but cows' milk and the best white sugar, and is well adapted for use during long voyages and in all other situations where good cows' milk is not readily procurable. A sample of preserved milk prepared by the Anglo-Swiss Company, on analysis, yielded the following results:

Water	24.89
Fat (pure butter)	8.36
Caseine (curd)	10.15
(containing nitrogen)	(1.624)
Milk and cane-sugar	54.18
Mineral matter (ash)	2.42
	100.00

About one-half of the solid substances of the condensed milk consists of sugar added in the process of condensation. The remainder consists of butter, caseine. milk-sugar, and ash constituents. It is but right to state that the analyses of other samples of preserved milk, prepared by the Anglo-Swiss Company, show about ten per cent. of butter, and somewhat less water than was found in the sample analyzed In buying condensed milk, however, one should know that it is pure. It is chemical test alone which will solve this. The only other recourse is to buy only of respectable companies who have a reputation to lose. It should be labeled so as to show that it is whole milk, honestly condensed. In fact all commodities of sustenance should be branded just what they are, and, if found adulterated or subtracted from, heavy penalties should be attached. The following tables will show some interesting information in relation to condensed milk taken from the United States Department of Agriculture Report for 1872:

Components.	Pure milk.	Pure milk condensed.	Condensed milk, New York Co'y.
	pr. cent.	pr. ceut	pr. cent.
Butter	4.00	16.00	1.75
Caseine	4.00	16.00	15.80
Sugar	5.00	20.00	18.90
Salts	0 65	2.60	2.21
Water	86.35	45.40	61.34
	100.00	100.00	100.00

In the latter case there remained not more than one-eighth of the butter contained in the original milk, seven-eighths having been skimmed off and sold for cream. It is a notorious fact that most of the condensed milk companies regularly send cream to the New York market. It is added that analyses of samples of the plain condensed milk of several companies, presented by Dr. Chandler in May 1872, are as follows:

Components.	American.	Borden.	Rockland.	Eagle.	Condensed milk—standard.
	pr. cent.	pr. cent.	pr cent.	pr. cent.	pr. cent.
Butter	13.74	11.39	11.67	11.77	13.12
Caseine	14.12	12.96	12.63	13 03	14.44
Sugar	17.24	14.12	13.89	14.38	16.30
Salts	2.64	2.30	2.24	2 36	2.60
Water	52.26	59.23	59.57	58.46	53.54
	100.00	100.00	100.00	100.00	100.00

Of the average adulteration of milk and its effect on prices, Dr. Chandler calculates, from long-continued investigation, that the milk supply of New York and Brooklyn receives, on an average, one quart of water to every three quarts of pure milk before the commodity reaches consumers. As the result of a large number of experiments with milk from different breeds, Dr. Sturtevant presents the following conclusions: The butter-globules of the milk show a certain and definite relation between the quality of the milk and the breed. The breed determines, to a large extent, the composition of the butter. The breed determines, to a large extent, the most economical and advantageous manufacture of cheese. In the Ayrshire and Jersey breeds he considered his experiments fairly complete; in the Dutch or Holstein breed, more limited. As to the characteristics of the milk of these different breeds, as indicated by his experiments, Dr. Sturtevant says: The milk-globule of the Jersey breed is larger than is the corresponding globule of the other breeds mentioned, and there are fewer globules under a certain size, one twenty-seven thousandth of an inch, and such, for convenience, I shall call granules. The milk-globule of the Ayrshire breed is smaller than that of the Jersey, and intermediate in size between those of the Jersey and Holstein, and the milk from individual cows of the Ayrshire breed can be grouped into two classes or grades, according to the size and distribution of the globules. This milk abounds in granules. The milk-globule of the Holstein is the smallest of the three. The globules are more uniform in their size than in the Ayrshire milk, and there are fewer granules. The globules determine some of the physical characteristics of the milk. If samples of the Jersey, Ayrshire and Dutch milk are placed in a percentage-glass, under like conditions, it will be noticed that the cream will rise in each sample with a different rapidity; the larger globules, on account of their less specific gravity, reaching the surface first. As a matter of experiment, some Jersey milk threw up its cream in four hours, leaving a blue skim-milk; some Ayrshire samples, in about ten hours, leaving a white skim-milk scarcely recognizable as such; some Dutch milk, in about five hours, leaving a blue skim-milk. The larger milk-globules, and few granules being in part the explanation of the first, the evenness of size of milk-globules and few granules the interpretation of the reaction of the third, and the numerous granules and unevenness of size of globule offering a solution for the appearance and action of the second sample. The milk of these breeds acts differently in the churn. The larger the globule, the quicker is the butter produced from the milk; and the more uniform the size of the globule, the larger the yield of butter from a given quantity of cream of equal richness by analysis. The globules of similar size appear to be evenly affected by the process of churning, and break at about the same time. This was well illustrated by an experiment made of churning a portion of milk from two cows separately, and weighing the produce. The amount of butter was largely in excess of that gained by churning the same quantity of the same milk mixed, and the microscope revealed the cause. A curious feature brought out by these experiments is, that the mixed milk from two breeds will not produce as much butter as will the same milk churned separately. The explanation is in the variation in the sizes of the globules. When a large-globuled milk and a small-globuled milk are churned together, the larger globules separate first into butter, and the breaking of the smaller globules appears to be retarded. When, therefore, a Jersey cow is kept in an Ayrshire or Dutch herd for the purpose of influencing the color of the butter, the large globules of the Jersey milk are broken first in the churn; and while the smaller globules are being broken, the butter which first came is being overchurned, and theoretically, at least, the quality of the result is impaired, if not the quantity lessened. When a few Ayrshire or Dutch cows are kept in a herd of Jerseys, and the milk churned together, both theoretically and practically a large portion of the butter of the small-globuled milk is left in the buttermilk in the state of globules. Dr. Sturtevant arranges the breeds in the order of the average size of the milk-globules, as follows: Jersey, Ayrshire, (butter family); Ayrshire, Holstein, or Dutch (cheese family). Likewise we can arrange the breeds in accordance with certain properties of the milk: the rapidity with which the cream rises—Jersey, Ayrshire, Dutch; the rapidity with which the cream churns—Jersey, Ayrshire, Dutch; the completeness with which the cream rises—Jersey, Dutch, Ayrshire; the value of the milk for cheese—Ayrshire, Dutch, Jersey; qualities desirable for the milk-retailer—Ayrshire, first; Dutch or Holstein, second; Jersey, third. In conclusion, the following, condensed from a statement by Mr. Gold, of Connecticut, will show the importance not only of keeping the cows healthy but also of exceptional cleanliness in the care of milk, from the time of milking through every stage of its manipulation. Cows differ almost as much in the quality of their milk as they do in their external form and appearance. The amount of the principal constituents, as caseine or curd, butter, oil, and sugar, can be easily ascertained and their variations marked, but there are more subtle qualities, giving rise to flavor and to its hygienic properties, which, while more difficult of determination, are of no less importance in a sanitary point of view and in the estimation of the customer. If the product varies so much when the animal is in health, how will it be when disease supervenes to form another important element in the calculation? Cows often continue to give a good flow of milk under local and constitutional disorders. The cow-pox, the fouls, garget, disturbances of the alimentary canal, foot and mouth disease, and pleuro-pneumonia, though interrupting, do not always prevent, the secretion of milk. The cow-pox, even in its mildest form, often causes the teats to crack and bleed, and the exudation may drop into the pail. Harsh handling of the udder in milking, or some slight injury, often causes one-quarter to give bloody milk; and garget, when it does not entirely stop the flow of milk, injures its quality in all degrees of vileness. All the secretions of an unhealthy animal must be tainted, and milk is no exception. Garlic and onions, and in some degree the cabbage family, to which the turnip belongs, give their peculiar odor to the milk. Weedy pastures abound in vegetation of strong odors and taste, liable to be transferred to the milk. Drink as well as food may introduce impurities. Out of 170 families supplied with milk from a dairy in Islington, England, seventy suffered from typhoid fever. One hundred and sixty-eight individual cases occurred in ten weeks, and thirty died. An investigation showed that the cows drank water from an old underground tank, built of wood and much decayed. Prof. Law, of Cornell University, relates a similar case where the milk had a ropy or slimy character, and a microscopic examination revealed the presence of certain animated germs, which had their rise in the filthy pool, from which the cows drank. These entered into the secreted milk, and there multiplied to such a degree as to render it entirely unfit for food. Even impure air breathed by the cow will taint her milk. It is reported on good authority that the milk from a dairy in the State of New York when brought to the cheese-factory was found tainted, and on examination the cause was discovered to be a putrid carcase lying in the pasture. Milk and cream set in the dairy are very susceptible to odors of every kind. The smoke of the kitchen, of cooking vegetables, are readily absorbed. The proximity of the hog-pen, or of the milking-yard, sometimes taints the milk. Wherever milk is kept, either in the spring-house or dairy, every pains should be taken to secure a pure atmosphere. When the milk is set in a kitchen, dust and smoke will affect it injuriously, and first-quality butter can not be made from it.

MILKING. The importance of regularity, care, and system in milking can not be overestimated. The quicker a cow is milked, the more completely will the milk be given down, and the ability to milk fast is only acquired by practice and an attention to the proper manner of obtaining the milk most easily. The act of milking is difficult to be described, and yet easy enough once the individual has been shown how. The teat should be grasped by the hand, the thumb and fore-finger should be first closed around the teat, and then the others in quick succession. Having squeezed it dry, raise the hand to the lower part of the udder, but without letting go entirely of the teat. It will almost instantly fill again, proceed as before, working each hand alternately, and so continue until the udder is stripped clean. When you begin to milk do not cease until you have milked the cow entirely clean. Slow milking not only needlessly worries the cow, and in the end dries her up, for if not taken as fast as it is given down it is apt in the end to be withheld. Milking should be done by grasping the teats diagonally, one forward and one hinder one. In stripping do not use the thumb and fore-finger pulling down. Every drop can be had by pressing the hand well up and under the bag, gathering the milk with the thumb and fore-finger, and pressing it out with the others.

MILKTREE, COWTREE. *Galactodendron dulce.* A tree of South America, of the same family as the fig (*Urticaceæ*). The sap obtained by tapping is like milk, and very palatable; it contains a creamy matter like beeswax, fibrin, sugar, an acid, salts, and water. Other trees also yield milk, as the *Clusia galactodendron* and the *Tabernæ Montana utilis.* The milky juice of most plants is acrid, and often very poisonous.

MILK VESSELS. In plants, the anastomosing tubes lying in the bark or near the surface of plants, in which a white, turbid fluid is secreted.

MILK-VETCH. *Astragalus.* This is an extensive genus of herbaceous and shrubby plants; many of the species are very handsome and well suited for the flower garden. There are four species indigenous to England

MILKWORT. *Polygala.* All the species of this genus are very showy. The annual kinds require sowing in the open ground, preferring a peat soil. Some of the species possess useful medicinal qualities. A considerable number of the species are natives of the United States, among which the best known is the *P. senega,* or Seneca snakeroot.

MILLIPEDE. The centipede.

MILLET. *Sorghum, setaria* and *panicum,* are all popularly and botanically denominated millet. Under the head Sorghum, this important genus will be treated. In this article only the millets, Italian, (*Setaria Italica*), and German millet (*panicum miliaceum*) usually known as Hungarian grass, (*P. Germanicum*). The first used to be largely cultivated under the name of millet and Bengal grass, but it has lately given place to Hungarian grass. All farm stock take kindly to the hay made from Hungarian grass, but if the seeds are allowed to get ripe, it is supposed to bring on disorders of the kidneys, especially in horses. For this reason it should be fed rather sparingly to horses unless it has been cut when in bloom; cut at that time, we have never observed any evil effects from feeding the hay to horses. We have never, however, fed it except with full rations of oats, to working horses, and always cut it just as the blossoming season had past, at which time, any of the plants have their maximum of nourishment in the stalk and leaves. Fed to cattle it is an excellent forage, and if well cured will carry them nicely through the winter; two feeds a day and one feed of straw being given. In the absence of careful experiment to determine the precise effects it may have on stock, when fed steadily it would not be advisable to keep stock wholly on it.

MILL-STONE GRIT. A geological formation immediately under the coal; beds of coarse quartzose sandstone.

MILSEY. A sieve in which milk is strained.

MILVINES. A family of raptorial birds, of which the kite (*Milvus*) is a member.

MIMUS. The genus of passerine birds, of which the mocking-bird (*M. polyglottus*) is a species.

MINDERERUS SPIRIT. Solution of acetate of ammonia, a febrifuge.

MINERALOGY. The science which has for its object the examination and description of minerals.

MINIUM. Red-lead, used in painting.

MINT. (See Peppermint.)

MINUS. Less, distinguished by the mark—, and used in physics to designate quantities below a standard; thus, all degrees of temperature below zero (0) are minus, and read minus 50,—30, etc.

MIOCENE. The intermediate portion of the tertiary epoch, in which some seventeen per cent. of recent shells are discovered.

MIRAGE. *Fata Morgana.* Looming. An optical delusion, in which ships and objects at sea appear depicted against the clouds.

MIRROR. Any polished surface used as a reflector. Mirrors are plane, concave, or burning (magnifying), and convex, or minifying.

MISTLETOE. *Viscus album, verticillatum.* Shrubby, parasitical plants, growing occasionally on large trees. Many fabulous virtues were attributed to it.

MIST. That atmospheric condition in which the moisture of the air is condensed in fine drops (See Dew.)

MITE. A name generally applied to minute insects of various kinds, which attack the leaves of trees and plants, living by either burrowing under the epidermis, just as the mange insect does under the scurf skin of animals, and acari found on the outside of the leaves and tender shoots, subsisting by sucking the juices, which produces fungoid-like brown patches on the leaves of pear trees, and are so small as to be scarcely visible to the naked eye. They are sometimes found in myriads, as are all the louse family, and do great damage to various trees. The remedy is to use a wash of whale oil soap, weak carbolic acid, or in the case of such plants as may be small enough, (pot plants), to dip them in the solution by inverting the pot in which they grow. Fumigation with tobacco smoke is also a remedy. All infested leaves also should be picked off and burned. Mites as a class are wingless, belonging to the *acarii.* Those living on the outside of plants are called lice. Many minute insects that infest hams are dipterous (two-winged) insects in their perfect state. To this latter class the cheese mites belong, others are minute wood borers, the larvæ of minute beetles. They however, are not properly called mites, since only those we have named may properly be so called.

MITRAL VALVES. The valves of the left ventricle of the heart.

MITRE. In building, the junction of two pieces of wood, etc., by cross fitting.

MOBILITY. Capacity for movement, mobile.

MOCKING BIRD. (See Mimus.)

MODILLON. An ornament, or scroll, placed at intervals under the corona.

MOHAIR. The silky hair of the Angora goat, used for camlets and other costly stuffs.

MOISTURE. The water of all lakes, ponds, rivers, brooks, and springs, is derived from rain. This is the evaporation from the whole surface of the earth, whether land or water. This is held in suspension by the air, until changed meteorological conditions set it free, either as dew or frost, or as rain, hail, or snow. This moisture, some of it, runs off along the surface, some sinks down indefinitely to form springs. These two forms being the supply of lakes, ponds, and streams, the balance is held by the soil, to be given up to the roots of plants, to rise again by capillary attraction to the surface, and again to be given off to the air as evaporated moisture.. The moisture which runs off along the surface and that which enters into the soil by percolation will vary according to the nature of the soil. Loose soils will percolate all the water except those of the most dashing showers, where the angle of elevation is not acute. Water will always sink down perpendicularly, unless it meets with obstructions as rocks, strata of clay or other impervious substances. These impervious strata form the water line along which the water glides, at last to be collected in underground reservoirs forming springs. (See articles, Drainage, Meteorology, Rain-fall, etc.)

MOLARS, MOLARES. The grinding teeth, placed behind the incisors.

MOLASSE. A soft, green sandstone, of the miocene epoch, found in Switzerland,

MOLASSES. The thick, dark fluid which runs from raw sugar; it consists of uncrystallizable sugar, an acid, aromatic bodies, and water; when fermented, it yields rum by distillation.

MOLD. Mold is produced by fungus growths. The sporules producing mold being everywhere present in the air, and only requiring warmth and moisture to enable them to grow, wherever deposited. Bread mold, is a minute fungus, *Ascophora mucedo*, found on moist, starchy substances, in the process of decay. These minute cryptogamous plants are found in almost every substance, in the presence of heat and moisture, especially peas, hops, and other plants. Once it attacks it spreads rapidly, unless checked by dryness. Hence blight is the result of the action of mold, and not the disease itself; rather the action causing disability in the plant to perform its natural functions, and sometimes whole fields will be suddenly attacked, and the crop be ruined.

MOLD-BOARD. The large curved side of a plow, which turns the furrow slice.

MOLDINESS, MOLD, MILDEW. Minute cryptogamic plants, of a grayish aspect usually, but of all colors, which appear upon damp linen, cotton, and vegetable substances, as bread; they belong to the genera *Aspergillus mucor*, and other mucedines, and are to be avoided only by dryness and proper exposure to the sun and dry air. The genera which appear on plants, as the hop, pea, etc., are very numerous.

MOLE. The moles of America belong to the genus *Scalops*, and not to the true moles, *Talpa*, found in Europe. The ground mole, *Scalops aquaticus*, is found in the Eastern and Southern States. The Western mole, *S. argentea*, being found in Indiana, Michigan, Illinois, Iowa, Missouri, and Kentucky, and in fact in the valley of the Mississippi nearly to the gulf, being always found in dry land. The fore parts of this animal is strong and muscular, its fore hand-like paws, extending side ways, the more readily to enable it to make its way under ground, in excavating its galleries, in search of its food, which is entirely insectivorous. They have been accused of eating vegetable roots and tubers. This, however, is a mistake. It certainly often does much damage to garden crops, by loosening the earth and uprooting plants in burrowing. The only question for the farmer to decide, is whether the moles or insects do most mischief. We have seen lawns rendered unsightly by moles. So we have seen the grass entirely killed by the ravages of the larva, (white grub,) of the May beetle. A little labor will eradicate the burrows of the mole, but it is difficult to destroy the white grub, especially where they are so thick as to so entirely destroy the sod, that it may be rolled up like a carpet. It is undoubtedly true that shrew mice and other small rodents, follow in the tracks of moles, and eat corn, tubers and other vegetables, but there is no well authenticated evidence that the mole does so. When moles become so numerous as to be severely destructive, they may be trapped by sinking pitfalls of tile or other material under their run-ways, or they may be caught under deadfalls. These should be placed under one of their regular galleries, leading to their place of rest if possible, since it is not always that they travel in the surface burrows. They may also be poisoned by placing strychnine in small pieces of meat and laid in their burrows. The Star nosed mole, *condylura cristata*, is another species, and quite rare, except in some portions of Central Illinois, where it is rather common. It inhabits all the Eastern and Northern States to the Mississippi, and is found even in Minnesota. It prefers rather moist soils, and is found in the vicinity of swamps. It does not burrow to such great length as the species previously described, and is not so strong. Its fore feet are longer and narrower than the common ground mole, and the tail is longer and larger. It may readily be known by its ciliated nose, from whence its name.

MOLECULE. An atom not capable of mechanical subdivision. The minute atoms of which bodies are formed. Of organic molecules, the late Prof. Henry said, we are able to construct a crystal of alum, from its elements, by combining sulphur, oxygen, hydrogen, potassium and aluminum; but the chemist has not yet been found who could make an atom of sugar from the elements of which it is composed. He can readily decompose it into its constituents, but it is impossible to arrange the atoms artificially, as in the ordinary cases of chemical manipulation, to produce a substance in any respect similar to sugar. When the attempt is made the atoms arrange themselves spontaneously into a greater number of simpler and smaller groups or molecules of high order, each containing no less than thirty-four atoms of carbon, oxygen, and hydrogen. For the building up of organic molecules, the vital principle must come into play upon inferior groups of simple elements. Thus are formed plants, trees, insects, fishes, and sentient animals; in fact everything which has life. Atoms, once formed, may be combined and re-combined in the laboratory of the chemist, and new compounds arranged out of them. Organic bodies formed of organic molecules, are greatly complex, and readily distributed and resolved into a greater number of lesser groups. Thus taking the constituents of cane sugar, Prof. Henry shows that organic bodies, are in what may be called a state of power, or of tottering equilibrium, like a stone poised on a pillar, which the slightest jar will overturn; they are ready to rush into closer union with the least disturbing force. In this simple fact is the explanation of the whole phenomena of fermentation, and of the effect produced by yeast and other bodies, which, being themselves in a state of change, overturn the unstable equilibrium of the organic molecules, and resolve them into other and more stable compounds. Fermentation, then, simply consists in the running down from one stage to another of organic molecules, changing their constitution, and at last arriving at a neutral state. There is, however, one fact in connection with the running down of the organic molecules which deserves particular attention, namely, that it must always be accompanied with the exhibition of power or energy, with a disturbance of the ethereal equilibrium in the form of heat, sometimes even of light, or perhaps of the chemical force, or of that of the nervous energy, in whatever form of motion the latter may consist. It is a general truth of the highest importance in the study of the phenomena of Nature, that whenever two atoms enter into more intimate union, heat, or some form of motive power, is always generated. It may, however, be again immediately expended in effecting a change in the surrounding matter, or it may be exhibited in the form of one of the radiant emanations.

MOLE-PLOW. A plow provided with a deep, sharp foot beneath the sole to penetrate the earth. (See Draining.)

MOLE-TREE. *Euphorbia lathyrus.* Commonly called Caper Spurge, and, by the French, Epurge; a plant with a biennial root; stem two to three feet high; found in the United States in gardens and lots. It is a naturalized foreigner, and was originally introduced under a notion that it afforded protection against the incursions of moles.

MOLLITES. A disease of the bones, hoofs, etc., in which they become soft, and often flexible.

MOLLUSKS, MOLLUSCA. The animals inhabiting shells, and those of similar conformation, but without that covering; they are of low organization, and cold blooded.

MOLTING. Change of plumage. It takes place annually for the entire plumage, and also partially where feathers of new colors are produced.

MOMENT, MOMENTUM. The availing force of a moving body at any time; its velocity multiplied into its weight.

MONADELPHOUS, MONADELPHIA. Flowers in which the stamens are united into one mass by their filaments.

MONANDROUS, MONANDRIA. Plants or flowers having one stamen only.

MONAS, plural **MONADS.** A genus of extremely minute, simple, polygastric, infusiorials.

MONILFORM. Resembling a string of beads.

MONKSHOOD. *Aconitum napellus.* Wolfsbane, aconite. Handsome perennial-rooted plants, with large blue flowers, very poisonous and narcotic.

MONO. An affix to many compound words.

MONOCHROMATIC. Having but one color, incapable of decomposition by the prism.

MONOCHLAMYDEÆ, MONOCHLAMYDEOUS. All flowers with only one envelope, or perianth, as the tulip, lily. Those furnished with a calyx also, are called diclamydeous.

MONOCOTYLEDONS, MONOCOTYLEDONIA. Endogens. Plants and trees, the seeds of which have but one lobe, as grasses and palms.

MONŒCIA. Plants which bear pistillate and staminate flowers, perfectly distinct, but on the same stem, as Indian corn.

MONOGYNIA. Flowers with one pistil.

MONOMERANS. A section of the coleopterous insects, in which the tarsus is supposed to be formed of a single joint.

MONOPETALOUS. A corolla, the petals of which cohere into a tube: synpetalous, gamopetalous.

MONOPHYLLUS, MONOSEPALOUS. A calyx with the sepals united. *Monosepalous* is used to indicate the same form.

MONSOONS. The periodical trade winds of the Indian ocean.

MONSTROUS PLANTS, MONSTROSITY. Plants which, by cultivation or otherwise, have become changed from their original forms.

MONTANT. In building, any upright piece in framing.

MOON BLINDNESS. (See Eyes, Inflammation of.)

MOONSTONE. *Adularia.* Semitransparent feldspar.

MOON TREFOIL. *Medicago arborea.* A species of medick.

MOONWORT. *Botrychium.* A genus of indigenous, unimportant ferns.

MOOR-BAND PAN. The incrustation produced in some ferruginous soils. The pan may be calcareous in limestone soils, and when not very hard can be destroyed by the subsoil plow.

MOOR GRASS. *Sesleria dactyloides.*

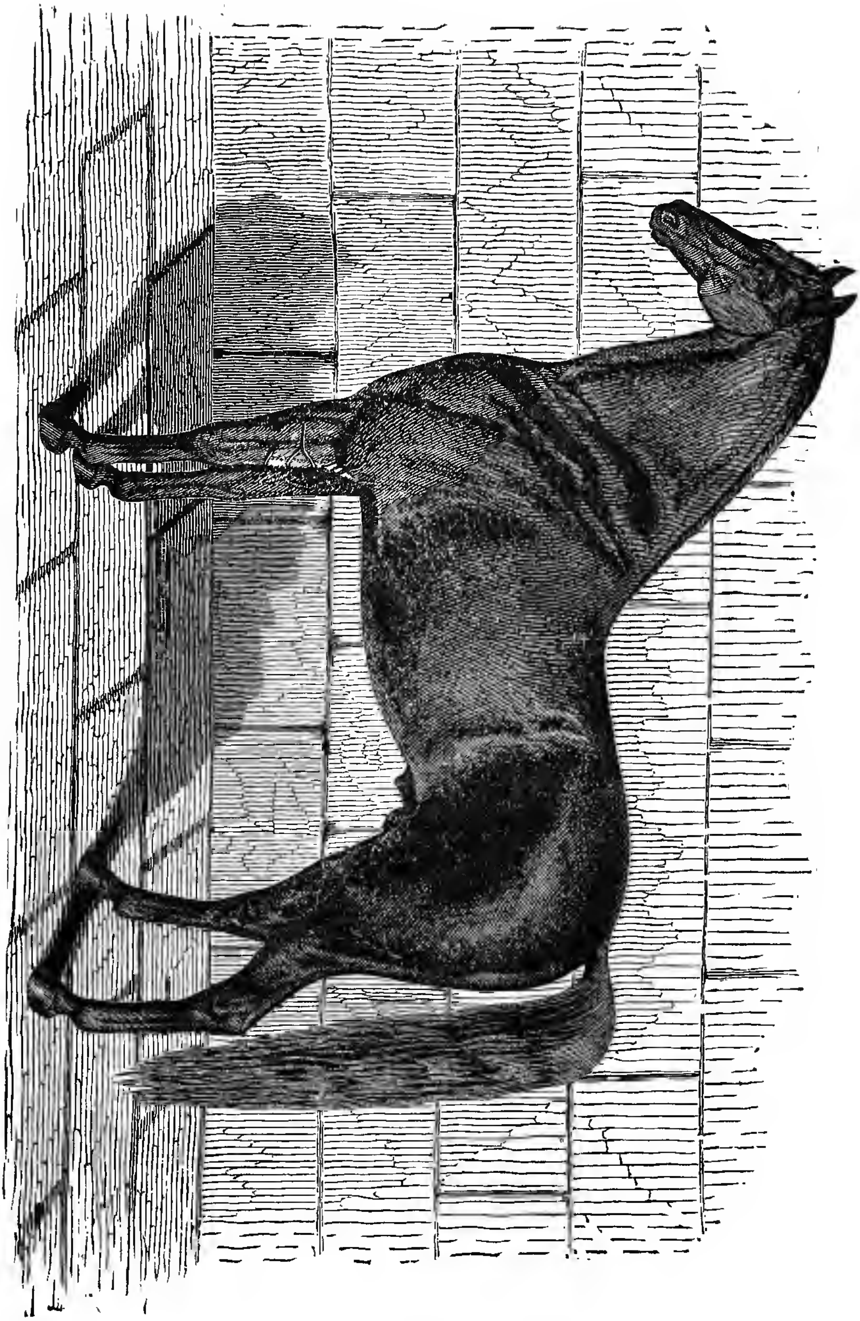
MOOSE. *Alce.* The largest of the deer genus. They live in troops in swampy places, and are confined to the northern portions of the States, and to Canada. The American moose is, *A. Americanus;* the European species is, *A. Malchis.*

MOOSE ELM. The red elm.

MOOSE WOOD. *Acer striatum.* The striped maple. This term is also applied to the *Dirca palustris,* or leather wood.

MORAINE. The longitudinal masses of stones and rubbish found at the bases and along the edges of great glaciers, or in places where they have existed.

MORASS. Swampy land.



BLACK HAWK (MORGAN).

MORDANT. A substance which unites chemically with the fiber of wool, cotton, etc., and with the coloring matter also, forming with both insoluble compounds. Acetate of alumina, alum, solution of tin, and pyrolignite of iron (red liquor) are important mordants.

MORDELLA. A genus of coleopterans, now the type of a family, *Mordellidæ*. They are heteromerans, with an elevated and arched body, low head, thorax, semicircular, or trapezoid, elytra very short, pointed at the tips.

MOREL. *Morchella esculenta.* The latticed mushroom. An edible mushroom much esteemed in Europe. It grows in woods, has a wide, hollow stalk two inches high, with a yellowish or grayish ribbed head, of small width, and two or three inches deep.

MORGAN HORSES. The Morgan horse, which probably owes its principal celebrity to the Black Hawk strain (see cut), and his descendants have years since passed the zenith of their popularity. Admirable as these horses were for light driving, their small size and light weight was against them, and in speed, except in rare instances, they could not compete with the descendants of Messenger and other first-class thoroughbred trotting sires. For draft teams they were found not to be of value for the reason heretofore assigned, the want of size. The stock was widely disseminated especially, in the Northwest, and while they added style and vigor to the common stock of the country, the decrease in the size of the get has rendered undersized horses much more common than formerly. Farmers were not slow to see this, and hence they were in as much haste to get rid of the blood as they were in the first place to breed to it. It is perhaps to be regretted that more of this stock could not have been kept pure, since their ambition, handsome form, docility, courage, and great style would have made them most acceptable horses, for pony phætons, for ladies and children and light driving on the road. The animal from which sprung the Morgan horses, is pretty generally conceded to have been the horse Justin Morgan, so named from the gentleman who bought him at two years old in 1795. He is recorded to have been foaled in 1793, and to have been sired by True Britain, who was sired by imported Traveler. The dam of the Justin Morgan horse is reported to have been a Wildair mare, sired by Diamond, and he by Wildair. The horse Justin Morgan was a dark bay, with black mane and tail, and without white hairs; he was about fourteen hands high, weighing about 950 pounds, and with coarse, heavy, but straight mane and tail, docile, obedient, spirited, and a fleet runner at short distances. He was not a fast trotter but an honest one, going in four minutes to the mile easily, and as honest at a dead pull as he was exhaustless on the road. The most noted of his descendants were Black Hawk, though all of his get seem to have been imbued with wonderful stamina, spirit, and beauty of form.

MORNING GLORY. A convolvulus of which there are many species, chiefly twiners. Annuals, biennials, and perennials. *Convolvulus major* is the well known morning glory, climbing plants of various brilliant colors, and effective for covering trellises, rock work, etc. *C. tricolor* is the dwarf morning glory, more or less trailing in habit, though some are of upright growth as *C. Mircaulis.* *C. Mauritanicus* is fine for hanging baskets and vases. Of the convolvulus family, the *Ipomeas* are a superb class of twining plants. The Cypress vine, *I. quamoclit* is well known. *Bona nox* expands in the evening. A curious variety, *leptophylla*, from Colorado, has an immense bulb, which is perennial, the stems being annual.

MOROXYLIC ACID. An acid found in the bark of the white mulberry tree.

MORPHIA. The active narcotic principle of opium.

MORPHOLOGY. The doctrine of the metamorphosis of plants, from which it appears that petals, stamens, and carpels are merely modified leaves; that their position and mode of development are similar to that of leaves. A seed is also analogous to a leaf bud.

MORTIFICATION. Gangrene; the death of part of the body. When it occurs in the limbs, a distinct line of separation of a red color may be seen between the mortified and living parts; the limb should be removed as soon as possible above the healthy part. Mortification of internal organs, when extensive, is necessarily fatal; when it comes on there is great loss of strength, freedom from pain, usually a disagreeable or gangrenous odor, delirium, cold sweats, and death. The lungs are most subject to gangrene, as a consequence of inflammation. Sloughs and sphacelus are small portions of gangrenous flesh removed from wounds.

MORTISE. The union of two pieces of wood or other substance, by introducing one into a hole made in the other; the former is called the tenon.

MORUS. The generic name of the mulberry.

MOSSES. In common language, are any minute, small-leaved, cryptogamic plants. Thus club-moss is a lycopodium; Iceland and reindeer mosses are lichens; and the numerous species of Jungermannia are all comprehended under the same term. But in systematic botany no plants are considered mosses except such as belong to the natural order, *Bryaceæ* or *Musci.* Such plants are simple-leaved; without spiral vessels or stomata; with a distinct axis of growth; and with the sporules, or reproductive matter enclosed in cases called sporangia or thecæ, covered by a cap or calyptra. It is not a little singular that such plants should have cases called staminidia, containing powdery matter; among which are found animalcules, not distinguishable from such as are called spermatic, and which swim about freely in water. None of the mosses are of any known use, except for the purpose of packing plants, and surrounding their roots when they are sent to a distance. They are bad conductors of heat, and might be employed, instead of straw, to guard delicate-growing plants from the influence of frost.

MOTH. The common understanding of the word moth, is the larva of a class of insects, *Tineæ*, which destroy clothing, carpets and various fabrics. The term, however, now includes entomologically, the genus *crambidæ*, in which the bee or wax moth is placed. The word is also used to designate the perfect insect of those caterpillars, which are hairy, (downy) and fly by night. The various species are all noxious and however brilliant the perfect insect may be they should be destroyed wherever found.

MOTHER-WATER. In chemistry, the solution from which crystals have been obtained, and which furnish a second supply when evaporated.

MOTION. In mechanical philosophy, motion is the change of place; that is, of the part of space which the body occupies, or in which it is extended. Motion is real or absolute when the moving body changes its place in absolute space; it is relative when the body changes its place only with relation to surrounding bodies; and it is apparent when the body changes its situation with respect to other bodies that appear to us to be at rest. All the phenomena of motion are derived by mathematical deductions from the three following laws of motion of Newton: A body must continue forever in a state of rest, or of uniform motion in a straight line, if it be not disturbed by the action of an external cause. Every change of motion produced by any external force is proportional to the force impressed, and in the direction of the straight line in which the force acts. Action and reaction are equal, and in contrary directions; that is, equal and contrary changes of motion are produced on bodies which mutually act on each other.

MOTTLED. *Maculatus.* Stained with colored blotches or dots.

MOULDING. The curved or straight lines, or fillets used in architecture, as decorations or members of the common orders.

MOUNTAIN ASH. (See Apple.)

MOUNTAIN LAUREL. *Kalmia latifolia.* A handsome shrub; the flowers are poisonous. It sometimes grows fifteen or twenty feet high.

MOUNTAIN LIMESTONE. The strata of this material lies immediately below the coal measures.

MOUNTAIN MAHOGANY. *Betula lenta.* The black birch.

MOUNTAIN MAPLE. (See Maple.)

MOUNTAIN RICE. *Oryzopsis asperifolia.* A perennial; culm almost naked, leaves rigid, erect, and sharp at the point; flowers in a panicle.

MOW-BURNED. Injured by fermentation in the mow. Fodder, when too green, heats rapidly, becomes black, and acquires a bituminous taste; this is disagreeable, and sometimes injurious to cattle.

MUCID ACID. An acid produced by the action of nitric acid on gum and sugar of milk. It is a white crystalline powder, feebly acid, soluble in six parts boiling water, and insoluble in alcohol.

MUCILAGE. A thick solution of gum in water. The ropy fluids extracted from certain plants by pressure are also called mucilage.

MUCIVORA. A family of dipterous insects, which feed on the juices of plants and decaying matter.

MUCK. A name for peat, marsh mud, and decaying vegetable matter generally.

MUCOUS MEMBRANE. The membrane which lines the mouth, nostrils, exterior of the eyes, lungs, stomach, intestines, bladder, and, urinary apparatus. It secretes an animal fluid, mucus, by which it is moistened and protected from the contact of air and other substances. Irritations and inflammations are very common, and do not extend so rapidly as in other membranes. They are usually subdued by bleeding, cathartics, or special medicines when the lungs or urinary membrane is attacked.

MUCRONATE. In botany, a leaf or other organ, having a rounded extremity, tipped with a sharp point or prickle.

MUCUS. The viscid, ropy secretion of the mucous membrane. It contains five per cent. solid matter (albumen), and is azotized.

MUD. The fine particles of earth and organic matters suspended in rivers, etc., and deposited by subsidence. When mellowed by exposure to frost, and composted with one bushel of lime to the cubic yard, it makes a good amendment to loose, thin soils destitute of humus.

MUD FEVER. Scratches. (See Grease.)

MUDER. *Calotropis gigantea.* An asclepiadeous plant, used in scrofula in the East.

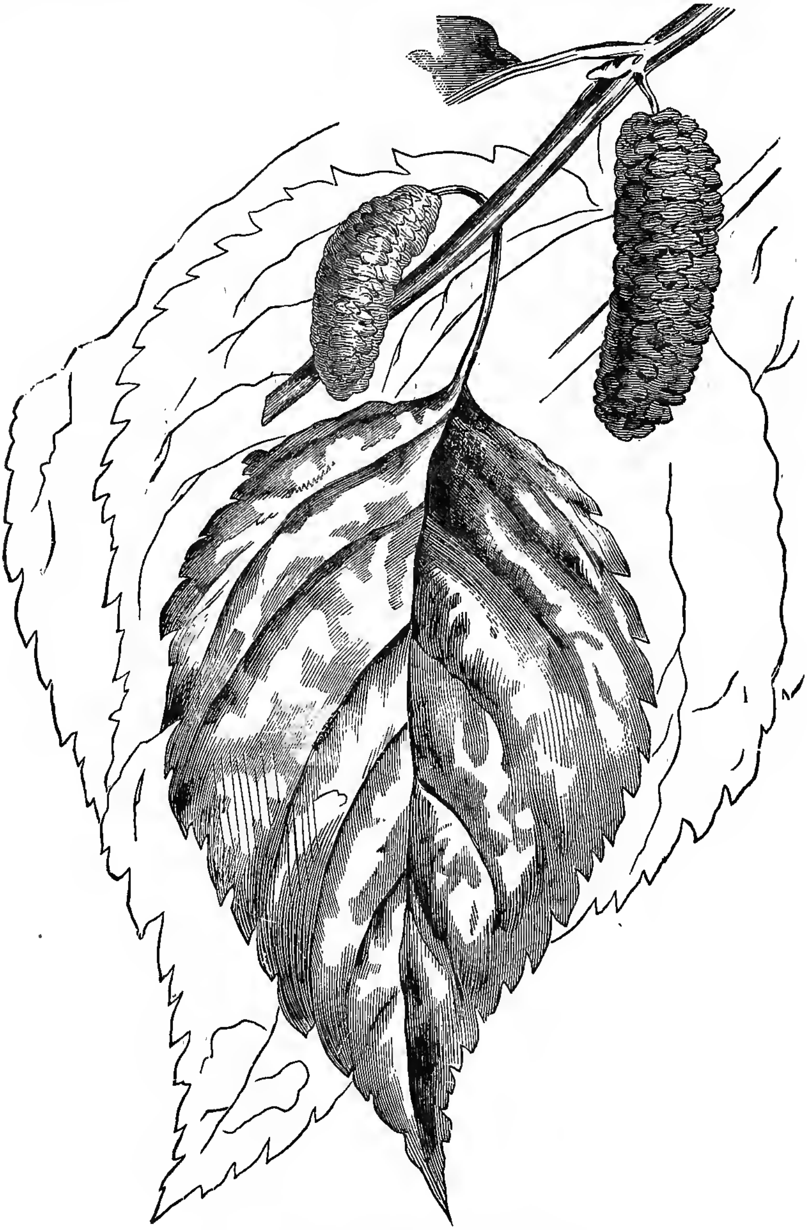
MUFFLE. A semi-cylindrical vessel of earthen-ware, capable of resisting a high temperature, in which crucibles are placed in assaying, and by which means they are exposed to a great heat without coming in contact with the fuel. The upper, curved side, is usually cut into slits, to allow the passage of reflected heat.

MUGWORT. *Artemisia vulgaris.* A kind of wormwood.

MULBERRY. *Morus.* The red mulberry, *Morus rubra,* is the only native species of the mulberry in the United States. The black mulberry of Europe is occasionally cultivated for its fruit. The white mulberry, *M. alba,* is cultivated in silk growing regions for feeding silk worms, and the paper mulberry, *Broussonetia papyrifera,* is grown sparingly as a shade tree. Our native mulberry delights in rich, moist, bottom lands, where we have seen it, in Illinois, two feet through. Usually the tree is only of moderate size. The timber is most lasting and valuable, almost rivaling live oak in durability. As a shade tree and for ornamental planting the native mulberry is not desirable, except in extensive grounds. Grown singly, it is a spreading tree. It is liable to the attacks of but few insects, the wood is valuable for turning and carving, and the bark is sometimes used in the place of cordage, after having been first steeped in water to separate the fibers. The bark of the root is reported to be a cathartic and vermifuge. The mulberry is propagated either by seeds or from cuttings; the cuttings grow easily, and where a given variety is wanted, cuttings must be resorted to, since plants do not come true from seed. There are a number of sub-varieties in cultivation, bearing superior fruit. The fruit, however, is not held in much estimation, except by children, and if it were, it is entirely too soft for shipping. An exception, however, should be made in respect to Downing's everbearing mulberry; a cut of leaves and fruit, which we give, natural size, on page 54. The fruit is one to one and a half inches in length and from one-half to five-eighths of an inch in diameter, and under high cultivation will exceed this size. Color, purplish black, and of a rich sub-acid taste. The tree is hardy, vigorous and comes into bearing the third or fourth year after removal from the nursery, the fruit growing larger as the tree acquires age. The tree is elegant in itself, and seems quite worthy its distinguished originator, Mr. Charles Downing, of Newburg, N. Y. It is now thirty-six years since it was first originated.

MULBERRY CALCULUS. A stone of the bladder of the color and appearance of the mulberry fruit, and consisting of the oxalate of lime.

MULCH. Any dry litter placed about trees, or vines, covering the ground, is called mulching. The object of mulching is to keep the soil cool, moist, and free from weeds, and to protect the roots from freezing in winter. Hence the more porous the mulch the more valuable it becomes. Hence green grass, manure or tan bark, should be used sparingly. Two inches of tan bark is the most that should be applied. The best possible mulch is charcoal dust. This however is costly anywhere, and generally difficult to get. Mulching is beneficial to vines and small fruits if applied after a general rain, and after the season of cultivation has passed to remain during the winter and removed when the season of cultivation returns, for mulch is not expected to supersede cultivation, but to supplement it. So any garden vegetables may be mulched with profit after they have gained sufficient size so cultivation may cease. Even in the case of fruit trees we are not in favor of keeping the ground constantly covered with mulch, as has been



DOWNING'S EVERBEARING MULBERRY.

advocated by some. It induces root growth at the surface of the ground if persisted in, and this will be detrimental to the tree when the final removal of the mulch is decided on. In winter mulching, especially of trees, the mulch should not be placed next the stem, since it induces the attacks of mice.

MULE. A mule is a hybrid between two species of the same genus. Thus, there may be as many varieties of mules as there are species that are fertile one with another. (See article Hybrid.) By common consent however, the term mule is understood to be the product of the male ass and the female horse. The mule is a very timid animal and there is no stock on the farm that requires such careful handling. If properly treated, they are gentle and perfectly safe. If abused they soon become vicious and learn to use their heels. In the raising of mules it is not so usual to halter break them at weaning time or before as it is with colts. We have, however, always done this, since when the mule is finally taken up for work at two years old, they may be considered half broken. In fact it is generally the case, that if kindly handled, the young mule will go right along, rather awkwardly it is true, but nevertheless, steadily, the first time they are put to the wagon. Until the mule is three years old, it should not have anything but light work. Thus they will be more active than if allowed to go until three years old before being broken; besides this they will not be so strong and difficult to handle. In handling the young mule either to halter break or to labor, care must be taken that it does not get away since if so it will never be forgotten. The same general rules may be followed as advised for the horse, which see, but, the mule will be more quiet and more easily approached to handle, if a a horse or broken mule, with which it is acquainted, be present. Even another unbroken mule will tend to inspire confidence. Mules are particularly sensitive to cold, far more so than horses. On the other hand they are far less affected by heat than horses. Thus mules, whether the young and growing or the working mules must have warm stabling in winter. In the South the protection of a good wood lot is by some considered as sufficient, the best masters, however, provide warm sheds in addition. From the time the young mule is dropped until ready for work, it must be liberally fed, so it may be kept growing. There is nothing gained in allowing any farm stock to suffer for want of sufficient food. It is especially the case with mules. A mule that has been half starved and frozen during the winter, never recovers. It may indeed get flesh, but, will never be of the same stamina as the mule kept warm and well fed, besides, this extra feed enables the mule to go to work a year sooner than it otherwise would. A good lively two-year old mule will bring more than a stupid three-year old. South of 40° for all kinds of farm work and teaming on the road, mules are fully equal to horses. They are not so liable to scare, or if so, not so much inclined to run away. They stand the sun and heat better than horses, and require rather less care in cleaning. We have never found, that weight for weight, the mule would eat less than the horse. Their true value lies in being able to work hard in the hottest weather, which the horse can not. North of 40° the mule becomes less and less valuable, until north of forty-three degrees, the horse is the most serviceable and generally used. When they have warm stables in winter, they make admirable teams, even in the climate of Minnesota, since even so far north, in the West, there is plenty of summer weather that will seriously distress the horse. The proper color for a mule so far as service is concerned, is a self, dark color; cream colored mules, especially if they have a white skin, are soft and unserviceable. So, pure white mules are objectionable both in color and stamina. Spotted or calico mules, and light dapples are said to be always washy. Iron-gray, duns, and bays are the best colors, and mare mules are considered more hardy and trustful than horse mules and always bring a better price in the market. To those who have the facilities for breeding and rearing mules it is a particularly lucrative business. They will sell for more money at two years old, merely halter broken, than the average horse will at three, after being broken. The late and increasing demand for mules for export to Europe, has given a fresh impetus to the trade. St. Louis is the principal mule market in the United States. Buyers visit the farmers in the mule breeding districts, central Indiana, and Illinois and southeast of the Mississippi River, and southern Iowa and all of Missouri west of the river. Compared with horses there were in the United States in 1877, 1,443,500 mules, valued at $99,480,976, or an average of $68.91; of horses there were 10,155,400, valued at $610,206,631, or an average of $60.08, making a difference in favor of mules each of $8.83. This is an important showing as to value, when we remember the slight variation in the price of mules, in comparison with that of horses, and shows conclusively, that the profit lies in breeding mules rather than common horses, whenever the climate is suited to mules.

MULLEIN. *Verbascum.* The common mullein, *V. Thapsus*, is fortunately not common in the West, seeming, like the Canada thistle, to delight in dry soils. Wherever found it is generally on very dry or poor, sandy lands. It is a biennial plant with woolly, entire, and alternate leaves throwing up its flower spike the second year from seed. It is usually indicative of worn or poor soil; perhaps one reason why it is not more found in the West, the fertile soil not being congenial to the plant. *V. Blattaria* or the moth mullein and *V. Lychnitis*, are also common in some localities, but are not considered so common as the common variety.

MULLION. The upright post or bar dividing two lights in a window.

MULTIARTICULATE. A term applied in natural history, to the antennæ, legs, etc., of animals or insects which have many joints.

MULTIFID. Divided into many segments.

MULTILOCULAR. Having many compartments or chambers.

MURIATE. (See Chlorine.)

MURICATE. Thorny. In zoology, a surface armed with short conical eminences, having a sharp apex.

MURIDÆ. A family of rodents, of which the mouse is a type.

MURRAIN. A disease, one of the forms of Anthrax, (which see). Bloody murrain is malignant anthrax, sometimes called black quarter from the engorgement of the neck, shoulder, quarter, breast, or side of the animal, producing a black and bloody appearance of the tissues in the latter stages of the disease. There will be lameness, stiffness, and great tenderness of the affected limb, with crackling when pressed, swelling of the parts, and sometimes oozing of yellow or bloody serum from the skin. Black tongue is another form, both in horses and cattle, with black, purple, or red blisters on the tongue, ending in sores, with more or less swelling. Murrain attacks all the herbivora, and may be communicated, in its malignant forms, to dogs, birds, and even man, taking the form in man of a malignant pustule, sometimes very fatal. As soon as murrain attacks a herd, remove all the well animals to a high, dry pasture, and the ailing ones to another entirely isolated. Above all let the water be pure. Put a seton in the breast, daily smeared with irritant ointment. As medicine, the following is recommended by the best English surgeons, especially by Youatt, than whom there is no better authority: Take two to four drachms chloride of lime, one ounce prepared chalk, two drachms laudanum, mix and give every two or three hours in warm gruel. In severe cases, French veterinarians recommend quinine in one to two drachm doses every two or three hours. Stimulants, as carbonate of ammonia, are also valuable. If a veterinary surgeon can be had, he would be likely to use hypodermic injections of two grains solu tion of iodine, five grains iodide of potassium, one ounce water, using a syringe full every hour, in extreme cases throwing it directly into the vein.

MUSACEÆ. A small family of tropical plants, resembling the marantaceæ, and including the plantain (*Musa sapientum*) and banana (*M. paradisiaca.*) The leaves are also used for thatch, and the fibers of the stem for cordage. The curious flowering plants called strelitzias are of this family.

MUSCICAPA. A genus of dentirostral passerine birds; living on insects and small birds.

MUSCIDÆ. A family of dipterous insects, resembling the fly (*musca.*)

MUSHROOM. Mushrooms are eaten by every civilized nation, when fresh, forming a delicate and palatable food. The difficulty in obtaining non-poisonous kinds, and the distressing and sometimes fatal effects of eating poisonous fungi deter many persons from using them at all. Nevertheless, a person may soon come to be able to determine between the poisonous and non-poisonous kinds. Prof. Peck, the New York State botanist, gathered eighty species there and Dr. Curtis, of North Carolina, has tested a list which we give further on. A species of morel, a peculiar, round, pock-marked fungus, is found growing under oak trees in northern Indiana and other oak openings in the West. The genus *Agaricus*, however, is the species generally cultivated. Mushrooms are propagated from spawn, sold in the form of bricks, and made as follows: A quantity of fresh horse-dung, mixed with short litter, is composted with one-third part of cow-dung, and a small portion of good loam. This compost is cut up into bricks, which are to be set on edge, and frequently turned, until they become half dry. Then a couple of holes are to be made in each, by means of the dibble, and in each hole is to be put a piece of spawn as large as a walnut. When the bricks are dry, they must be piled upon a layer of dry horse-dung, six inches thick, and covered with sufficient fresh dung to produce a gentle heat through the whole. As soon as the spawn has spread itself through the bricks, the process is ended, and they may be stored in a dry place, where they will preserve their vegetative powers for many years. Beds for the culture of mushrooms are constructed in several different ways. Sometimes they are in the open air, when they require a covering of boards to prevent injury from cold or wet weather; at other times, in boxes or baskets, in pits or frames, in sheds or moderately warm cellars; and again, in mushroom houses. The latter are decidedly the best, when the necessary expense may be justified. They are sheds built in a dry place, ten feet wide, and of any length desired. A walk runs through the center, so as to accommodate a bed on each side of four feet in width. In the first place, it is necessary to procure a sufficient quantity of good horse dung, and make it up into a heap, which must be turned frequently to induce regular fermentation. In a fortnight all the rankness will probably have escaped, when it will be time to build the bed. The dung should be well shaken by the fork, and built up with perpendicular sides to the height of twelve inches, and then gradually drawn to the center like the roof of a building. In a mushroom house, the beds should be three feet high on the back side, sloping toward the walk. Every forkful is to be well beaten into its place, so that the sides of the bed be even and firm. Cover the dung with long straw or litter, in order to exclude frost and prevent the escape of the volatile gases. In the course of ten days, or a fortnight, the temperature will be sufficiently reduced, and the covering is to be removed in order that one inch of fine loam may be laid upon the dung. On this plant the spawn, which has been broken into pieces of the size of a walnut, in rows six inches apart each way. Put on a second inch of mold, which, after being beaten smooth by the spade, must be protected by the covering of straw. Where the bed is in the open air, it will need mats during stormy weather. Guard against the extremes of heat and cold, and of drought and moisture. A medium temperature is probably somewhere about 60° The covering of straw must vary in thickness from three to twenty-four inches, according to circumstances. When the mold appears too dry, a gentle application of tepid water should be given in the morning; in summer, this may be necessary every other day, but in winter perhaps once a month. After each watering, the covering ought not to be replaced for some fifty or sixty minutes. If the operation be successful, young mushrooms may be expected in about five or six weeks after the date of spawning, although from a variety of causes, the time is frequently much longer. Where the bed has been kept too hot and moist, the spawn may have been destroyed; but, in many cases, it requires only a little extra warmth, or a gentle sprinkling of water, to produce a generous crop. In gathering mushrooms, after the straw has been removed, each one is drawn up by a gentle twist of the fingers, and the hole is then filled with earth. A knife ought never to be employed, because the stumps left in the ground become nurseries of maggots, which prove very destructive to the succeeding growth.

Mr. William Saunders, of Washington, D. C.. remarks on the mushroom, *Agaricus*, as follows, and describes the variety generally cultivated. The *Agaricus campestris*, or common mushroom, is the only species that is generally grown artificially. It is thus botanically described; Stipes, (or stalk,) two or three inches in length, white, solid, fleshy, furnished with an annular veil, (a thin membraneous substance encircling the stalk.) Pileus, (cap, or edible part,) fleshy, dry, convex, convexo-plane, white, changing from yellowish to brownish. Gills, (thin parallel plates, underside of the cap,) free, ventricose, (swelling unequally on one side,) pink, changing to deep purplish brown. Flesh (internal substance) white. There are several species of the *Agaricus* besides the preceding, and also a few varieties of the *A. campestris*, that are sometimes grown for the table. It is unnecessary to describe them here, as those who purchase spawn need be under little apprehension of receiving a spurious article; at least so far as my experience goes. I have never been disappointed in this respect. So far from there being any difficulty in growing them, I venture to say that not one in fifty who makes the attempt will fail. Of course some little attention is requisite, as with everything else artificially circumstanced. A knowledge of the condition under which they are most plentifully found in nature will be of material assistance to the grower. In very dry seasons, mushrooms are most plentiful in low situations, on rather strong soils; on the contrary, should there be much wet, they are more abundant in uplands and drier localities. A continuance of warm, dry weather, followed by slight showers, and a hazy, still atmosphere, brings them most profusely. These considerations are worthy of being kept in mind in their artificial culture. There is no particular season for making a mushroom-bed. In winter it requires to be under cover, and in summer the difficulty lies in keeping it cool and moist. Autumn is perhaps the best season for making a bed out of doors; and, if a constant supply be an object, a bed should be made up in some spare cellar about the beginning of November. Some varieties of edible fungi have been lately described by Dr. Curtis, which we give below; the italics refer to the generic name, and the Roman to the names of varieties:

Agaricus. (*Amanila.*) Cæsarius, strobiliformis, rubesceus.
Armillaria. Melleus.
Boletus. Luteus, elegans, flavidus, collinitus, granulatus, bovinus, subtomentosus, edulis, versipellis, scaber, castaneus.
Cantharellus. Cibarius.
Clavaria. (*Ramaria.*) Flava, botrytis, fastigiata, muscoides. tetragona, cristata, rugosa, uliginea, macropus, subtilis, pyxidata, aurea, formosa.
Clitocybe. Nebularis, odorus, giganteus, cespitosus.
Clitopilus. Prunulus.
Collybia. Radicatus, esculentus.
Coprinus. Comatus, atramentarius.
Corlinarius. Infractus violaceus.
Cortinarius. Pholideus, cinnamomeus, castaneus.
Fistulina. Hepatica.
Hydnum. (1. *Mesopus.*) Imbricatum, subsquamosum, lævigatum, repandum, rufesceus.
Hygrophorus. Chrysodon, eburneus, pratensis.
Lactarious. Torminosus, insulsus, piperatus, deliciosus, volemus, subdulcis,
Lspiota. Procerus, rachodes, excoriatus, mastoideus.
Marasmius. Oreades, scorodonius.
Merisma. Coralloides, caput-Medusæ.
Merisma. Frondosus, cristatus. confluens, giganteus, sulphureus, berkeleii.
Pholiota. Squarrosus, mutabilis.
Pleurotus. Ulmarious, tessulatus, Pometi, glandulosus, ostreatus, salignus.
Polyporus. (1. *Mesopus.*) Leucomelas, ovinus, poripes.
Psalliota. Campestris, arvensis, amygdalinus, cretaceus, sylvaticus.
Russula. Adusta, lepida, virescens.
Russula. Ochroleuca, alutacea.
Sparissis. Crispa, laminosa.
Tremella. foliacea, mesenterica.
Tricholoma. Russula, frumentaceus, hypopithyus, Columbetta, castus, albellus. consociatus, personatus.
Volvaria. Bombycinus, speciosus.

Dr. Curtis says that hill and plain, mountain and valley, woods, fields, and pastures, swarm with a profusion of good, nutritious fungi, which are allowed to decay where they spring up, because people do not know how, or are afraid, to use them. And adds: By those of us who know their use, their value was appreciated, as never before, during the late war, when other food, especially meat, was scarce and dear. Then such persons as I have heard express a preference for mushrooms over meat had generally no need to lack grateful food, as it was easily had for the gathering, and within easy distance of their homes, if living in the country. Such was not always the case, however. I remember once, during the gloomy period when there had been a protracted drought, and fleshy fungi were to be found only in damp shaded woods, and but few even there, I was unable to find enough of any one species for a meal, so, gathering of every kind, I brought home thirteen different kinds, had them all cooked together in one grand *pot pourri*, and made an excellent supper. One important use to which several species of fungi can be applied is the manufacture of catsup. For this purpose, not only is the mushroom, *Agaricus campestris*, and the horse-mushroom, *Agaricus arvensis*, available, but also *Agaricus rubescens* is declared to be excellent for the purpose, and a delicious, but pale, extract is to be obtained from *Marasmius oreades*. Other species, as *Coprinus comatus* and *Coprinus atramentarius*, are also available, together with *Fistulina hepatica* and *Morcehella esculenta*. In some districts, when mushrooms are scarce, it is stated that almost any species that will yield a dark juice is without scruple mixed with the common mushroom, and, it should seem, without any bad consequence, except the deterioration of the catsup.

MUST. The fresh juice of the grape before fermentation. Other juices capable of fermentation.

MUSTANG HORSES. The mustang has been denominated the wild horse of North America, and with the same truth as the term wild horse of South America is used. There are no wild horses in America except such as having escaped from domesticity in an early day have since become wild so far as the term may be properly applied to animals which are obliged to subsist entirely without the care of man. The mustang has descended from the Spanish horses brought hither by early adventurers, and escaping from confinement, have covered the plains of Central America, Mexico, Texas and California with vast herds, furnishing the Indians of the plains of Texas, New Mexico and Arizona with fleet and untiring chargers, domestication having had the seeming effect of improving their powers of endurance. The mustang as found on the plains of Mexico and Texas is undersized, slight limbed, long necked, long backed, and with seemingly weak haunches. Their hoofs, also, are inclining to flatness. Their heads are long, lean, but well shaped and well set. Their nostrils wide, and their manes and tails fine. Considering their external appearance they perform admirably under the saddle. They are easily outstripped by well bred horses, are vicious, but easily subdued, under the severe treatment of the herdsmen of the plains, or cow-boys as they are called, nearly as wild as the mustangs themselves. Their money value is exceedingly small, and year by year they are becoming less and less in numbers, civilization gradually rendering them less and less numerous, from the constant increase of better blooded stock among the ranches of Texas, and the stockmen of the far West.

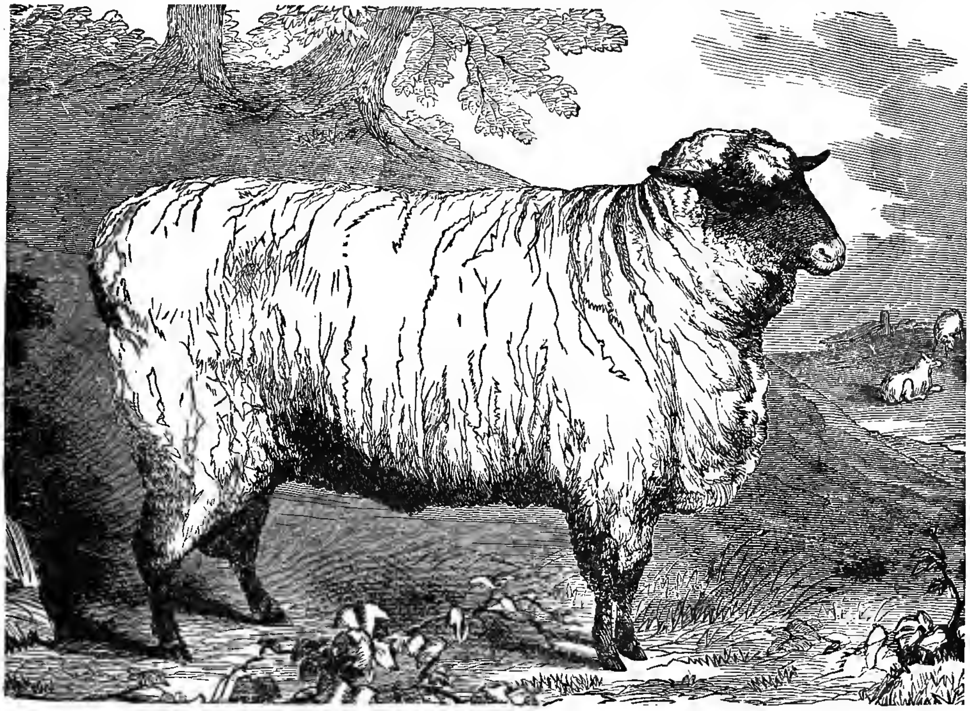
MUSTARD. The mustard family *cruciferæ* includes many most valuable plants to man: among them nasturtium, water cress, cabbage, turnip, the radish, horse radish, pepper grass and mustard. The varieties of mustard cultivated for the seeds which are ground into the mustard of commerce, are the white, *Sinapis alba*, and the black, *S. nigra*. The latter makes the stronger mustard, but the white the handsomest. The wild mustard, or charlock has come to be a most common and noxious weed in the West, infesting the fields of sloveuly farmers until some of the oat fields are yellow with the blossoms. It has come in generally by sowing the seed of badly cleaned flax, and following with oats, and then seeding with oats just as they come from the thresher. Thus for want of a little care in cleaning seed grain, fields have been overrun at a great expense to the outcome of crops, to say nothing about the unsightly appearance over large tracts of land. The seed may be eradicated by two successive crops of Indian corn kept clean, or by a clean kept corn crop and a summer fallow. The cultivation of the seed for manufacturing may be either broadcast or in drills, the latter preferable. A rich deep, moist, and mellow, sandy loam is preferable for the crop, though it will grow well on any soil of average fertility, if warm and tolerably well drained. In drills the seed should be sown rather thin, the drills two feet apart for ease in cultivation. If an implement is had that will work in an eighteen inch row this distance is preferable. When a majority of the seed is ripe or the pods turned yellow, cut with a reaper, and set it up like flax or buckwheat. When dry thresh immediately, having the bottom of the wagon rack covered with a cloth to catch the shelled seeds. Broadcast it may be sown a peck to the acre. In drills six quarts is ample. It will reseed itself, and to rid the land of it, plow under the crops when in flower, and follow with corn.

MUSTELLA. The genus containing the weasel and other vermin quadrupeds.

MUTAGE. A process to stop the fermentation of must. It is practiced either by diffusing sulphurous acid in the cask into which the liquor is racked by burning sulphur matches, or by adding a little sulphite of lime to the must; the latter is the best.

MUTICUS. Beardless, without awns, or aristæ.

MUTTON SHEEP. Within the last ten or fifteen years the demand for superior mutton has led to the extensive importation of sheep adapted particularly to the production of mutton. Flocks of the improved breeds are now found all over the United States, and especially within easy reach of our larger cities. The wool of some of the mutton breeds is also eagerly sought for by manufacturers of clothing wool, and for the manufacture of various fabrics in which a long stapled or combing wool is desired. For superiority of mutton the South Down stands pre-eminent everywhere. In the Atlantic States north, the South Down is crossed on selected grade Merino ewes, giving lambs that are much sought for. In the Atlantic States, South, South Down and Cotswolds are largely bred. In the West the Cotswold has become a favorite sheep, for its large size, constitutional vigor, and the length and quality of the wool. In Kentucky and Tennessee in the Blue Grass and other regions of flush pasturage, the Lincolns are gaining ground on account of their great size, and the length and luster of the wool. In the hill region, the Merino, the South Down and their crosses, are used. The Leicester is also much liked by many breeders East, West and South for their early maturity, and fattening qualities for the food eaten. On the great plains and the mountain regions of the United States, where sheep are herded in immense flocks, the Merino and its crosses with native and Mexican sheep are used, since the larger breeds do not work well in large flocks. One hundred of mutton sheep is about the number that should be flocked together, but the natives and Merinos may be kept in flocks of one thousand or more. The natives and Merinos, either Spanish, French or American Merinos, are not distinctively mutton breeds. In fact the quality of their mutton is not first rate, neither is it produced of any considerable weight per carcase. Yet in the United States, from the large numbers kept, the bulk of the mutton of the country is produced from natives, Merinos, and their crosses. Yet in treating of mutton sheep, they will not be included, but will be found under the head of fine-wooled sheep, which see. The breeds of sheep therefore that are considered the best breeds for mutton are the coarse wools, short, middle and long, as distinguished from the finer Merino wools. Of the improved mutton breeds, the South Down holds its rank against all others, but in the United States, wool as well as mutton must be taken into consideration. Then again Americans are not so choice in their taste for mutton as the English and hence the larger breeds that will produce high grades of combing wool, weight of carcase, and aptitude to lay on flesh are sought for. Nevertheless in the neighborhood of large cities, prime South Down mutton will always pay. The Lincolnshire sheep, one of the largest races in England, will show the best staple of long combing wool, next in rank is the Leicester, a race of sheep for combing wool the most generally distributed of any in England. It is tender in constitution, but of early maturity, and prime fattening quality. The next in rank for combing wool are the Cotswold sheep. In the United States, and especially in the West the Cotswold are much liked, they are hardy in constitution, mature well and make excellent mutton except it is rather fat. The long wooled sheep that have been the most widely disseminated in the United States, of the short or middle wools, are the South Downs, the Hampshire Downs, the Shropshire Downs, and the Oxfordshire Downs. Of these the Hampshire Downs are the largest, averaging 113 pounds thirteen ounces each, and the South Downs eighty-eight pounds, in two lots of fifty each. Of the long wools the Cotswolds, Leicesters, and New Oxfordshire, have been widely spread. Of these fifty each of Leicester and Cotswold weighed to average the first 101 pounds and the second 119 pounds thirteen ounces each. The Leicester as generally shown in this country and in England are larger, rivaling the Cotswolds in weight. Even in Canada where much attention is paid to Leicester sheep, there is said to be comparatively few flocks of the true Leicester, probably from the fact that the true Leicester is delicate in constitution. Yet they have early maturity, good form, and tendency to fatten, and are said to have been made by crossing the Leicester on Lincolns, and other of the large breeds. In England, Leicester wethers from twelve to fifteen months old have been marketed to weigh from 120 to 150 pounds each. The fleeces will average six to seven pounds each. In this country they have been sheared, wethers up to fifteen pounds, and breeding ewes eight pounds. The New Oxfordshires were produced between Leicester and Cotswold, the latter blood predominating. Yearlings in ordinary flesh weigh 125 to 175 pounds, and fat, full grown wethers from 175 to 200 pounds. For mutton, however, the Downs excel all others in the superiority of their flesh, and they are justly prized here as in England, where quality is the test. Mr. J. R. Dodge, in a late visit to England, thus describes them, and some other mutton breeds as he saw them. Speaking of the Downs he says: The distinguishing characteristics of the ancient Sussex Downs have been retained more fully in the course of improvement than have the peculiarities of any other improved breed. That improvement has been effected, as I have little reason to doubt, solely by selection, there being little, if any, positive evidence that the Leicester or other blood has aided in the amelioration. In the production of Hampshire and Shropshire and other breeds, bearing the Down name, it is well known that other blood has been effectively used; but it should be remembered that these families, or rather breeds, are not really improved Downs, but have come from selected individuals of other hardy primitive breeds, moulded into a modification of the South Down type by large and repeated infusion of that blood, with occasional dashes of Leicester to give greater size and aptitude for fattening. The changes effected in the true South (or Sussex) Down have been mainly these: Speckled faces have been changed to a uniform tint of brown or fawn color, sometimes almost a gray; the forehead and cheeks have been partially covered with wool; a greater symmetry of form has been obtained; a larger size and greater fattening aptitude. The flock of Lord Walsingham exhibited some deviation from the Sussex type, having somewhat greater length and a decided development of the fore quarter, giving greater weight, at the expense of reduced value, to the butcher. They are splendid animals, and have been largely sought by continental purchasers, though disapproved by many breeders of the South Down in its purity. The true South



HAMPSHIRE DOWN RAM.

Down may, perhaps, be considered a purer breed, stamping its peculiarities upon its cross-bred offspring more certainly and strongly than any other of the English breeds; and for this reason, together with its hardiness and the unsurpassed quality of its mutton, it is deemed of greater practical value in its crosses than in its pure-bred flocks. But for the fact that quantity and quickness in lamb production are of more pecuniary value than superior quality, it would far surpass the Leicester in its prevalent use for cross-bred early lambs. The Hampshire Down, see cut page 665, bred largely on the chalk-downs of Berkshire, Hants, Wilts and Dorset, was originally the result of crosses upon the Wiltshire horned sheep and the Berkshire Nott, which secured greater size and increased hardiness of constitution. Sixty years ago, in the hands of different breeders, working with different aims, there was a lack of uniformity, which began to disappear about 1845, under the skillful efforts of modern breeding, and the necessity of obtaining superior flesh-making tendency through an infusion of the blood of some of Jonas Webb's largest and best-fleshed Downs. This Hampshire, or West county Down, much larger than the true Down, and superior in fattening aptitude, is the natural result of the enclosure of the commons, the introduction of artificial manures, and the production of such crops as turnips, rape, vetches, trifolium, rye and Italian rye grass. This is one of the facts with which the history of British sheep husbandry teems, illustrating the necessity of change in breeds, with changed conditions of production or consumption. It is estimated that the weight, both of mutton and wool, have been increased in this region fifty per cent. The statistics of 10,000 Hampshires for three successive years showed the average yield of lambs to be ninety-one per cent., the mortality of ewes, five and a half per cent., and of tegs, three per cent. per annum. The wool is of fine quality, but short staple, averaging four and a half pounds per fleece. The best specimens of these sheep may be found at the Overton and Weyhill fairs, in Hampshire, and the Britford and Wilton fairs in Wiltshire. The wether lambs are now usually sold in the latter part of summer or early autumn, and the ewes are kept three years for breeding. The Shropshire Down, though of comparatively recent origin, still occasionally exhibiting variations from absolute fixity of type, are very widely diffused and highly regarded. They resemble the Sussex Downs, with greater size and weight, a somewhat longer face (which is uniformly dark in color, but not black), a full and large eye, flat and well-wooled forehead, and thin and erect ears of good size. The quality of the flesh is superior, being close-grained, the tissues well bedded in fat, and the color dark and rich. And while the mutton is claimed to be equal to the best South Down, the fleece is much heavier, a fine flock on good land often yielding seven pounds per fleece. They do not mature quite so early as the Leicester or Cotswold, on account of the closer texture of the meat, but with ordinary management yearlings can be marketed in good condition during the summer without other supplies than abundant grass. It is a very prolific breed, twins coming in large proportion—fifty per cent. of doubles being a common result. There have been instances in which a flock of a score or two of ewes have brought up more than twice the number of lambs. The yearlings are frequently made to yield eighteen to twenty pounds per quarter as early as May. There is a reported instance of an old wether being fed up to fifty-nine pounds per quarter. As compared with the Hampshire, they are less in size, but they mature earlier. The Oxford Down is another improvement of local forms of this branch of farm economy, and locally highly esteemed. There is another breed of English sheep inhabiting the rich, alluvial soils of Kent, known as the Romney Marsh sheep, which pertinaciously retains its distinctive features, though modified and improved by recent breeding. It is a large sheep, not very symmetrical in form, having narrow fore-quarters and flat sides, and coarse bone and muscle. It has a white face, a long and thick head, and a tuft of wool on the forehead. The wool is of more value than the mutton, perhaps (but would not be profitable without it), being long, fine and lustrous, and in demand at good prices for export to Flanders and to France for the manufacture of cloth of gold and similar fabrics. Other breeds have been introduced upon the marshes, but can not maintain themselves in competition with the Romneys. The country is flat, open to the east, and very bleak, yet these sheep live through the winter in the open fields, and have little protection or supplied feed. The ewes are comparatively prolific, about thirty per cent. of doubles being expected in reproduction. The lambs come late, after the severity of the winter is over. With a good course of turnip feeding, after the first wintering, they can be brought to seventeen pounds, sometimes to eighteen pounds per quarter, yet they are more usually kept over a second winter. They are not very early in maturing, and grass is the main reliance for growth, if not for fattening. The lands where breeding sheep are kept generally carry three per acre in winter, and five or six in summer. The fattening fields carry four or five sheep. There are cattle on the farms, but sheep greatly predominate, and furnish the principal profits. The breed of British sheep kept to the greatest age, and fed almost exclusively upon the natural growth of permanent pastures, and the management of which, therefore, bears the nearest analogy to our own practice in sheep-husbandry, is that generally known as the Scotch Black-face. It also has the widest range of any of the British breeds. It is found, and has been for centuries—so long a period that doubts exist whether they are aboriginal or an importation during the Norman conquest or the Norwegian occupation of the Western Isles—upon nearly all the mountain lands of Great Britain, including much of the area of Scotland, the mountain chain extending through the north midland counties of England, and the heath and moorlands both in England and Scotland. They are a hardy race, whose place could not be occupied by any of the more improved breeds, enduring, to an almost incredible extent, both cold and hunger, and getting a fair subsistence beneath the drifts of winter, thriving where the pampered long-wools would starve. And yet they are not Merinos. Their wool is of inferior quality, hairy, uneven, used for carpets and coarse cloths, and weighs about four pounds per fleece. The average three-year old wether yields twenty-eight pounds per quarter, deemed unequaled by epicurean taste in quality of meat and richness of gravy. The ewes are kept for five years, and are then drafted without distinction, while the wethers are full grown and fat on good grass lands at three, but they are now generally sold for fattening on turnips in the low countries. Thus the slowest of breeds in maturing is made to subserve the purposes of meat-production, and increase the farm profits under apparently unfavorable conditions. As the Black-faces monopolize the higher mountain lands, the Cheviots occupy the lower elevations, the hills of the border counties between England and Scotland. They have been systematically improved by the crossing of carefully selected rams of Lincolnshire, before the day of the improved Lincoln race. It has been claimed that the Leicester blood produced the improvement, but the hardiness of the breed and the testimony of breeders tend to invalidate the opinion. They were formerly light in bone and wool, of scraggy frame, but with a constitution wonderfully hardy. Draining of lands, provision of shelter, and a greater abundance, both of summer and winter food, have aided the efforts of the breeder, and the result has been one of the most useful and profitable of known breeds of sheep. No animal has so contributed to the prosperity of the Scottish border and hill farms as the Cheviot sheep. Their mutton ranks very high in the Smithfield market, and some people give it a preference over the game-flavored mutton of the Black-face. In the mountainous section of Somerset are found the Exmoor sheep, a horned breed, so hardy that a few days' burial in a snowdrift is said to be not too severe a test of their endurance. They have long been remarked for their drum-like roundness of form, though they are becoming square under the recent efforts of breeders They are larger, and in all respects better than the Welsh mountain sheep, good feeding bringing them up to eighteen and twenty pounds per quarter, and in some cases to twenty-four pounds. At eighteen months they can be made to weigh fifteen to twenty pounds per quarter. The Welsh, the Scotch Black-face, the Cheviot, have been tried upon the Somerset hills, but most farmers have gone back to the improved Exmoor. They have white faces, legs and fleeces; the wool close set, and now increased in weight from three pounds up to four pounds. Their mutton is considered of excellent quality. The drafted ewes are often purchased for lamb-breeding, as they are prolific mothers and good nurses. The Welsh is another mountain breed, indigenous and still unmodified in the higher elevations, while they are the basis of the more cultivated flocks inhabiting the more productive valleys. They are small, weighing as store sheep about seven pounds per quarter. The head is small and well set up; the poll clean, except sometimes a tuft upon the forehead; the faces unusually white, with occasional instances of gray, speckled, or rusty brown. They are narrow-chested, low-shouldered, high-rumped, long-tailed, active in movement, having little regard for fences or hedges, hardy and thrifty with scanty herbage. The wool is fine, though not very even in quality; fleeces weighing about two pounds. They are not prolific, as one lamb is enough for a mother to care for in mountain pastures, but are good nurses, and are sought for on that account for breeding fat lambs from Leicester or Down crosses.

MUZZLE. The nose of an animal. A kind of halter fastened over the nose to prevent an animal from biting. Muzzle of a plow is the end of the beam to which the clevis is attached.

MYCELIUM. The young, flocculent filaments of fungi. (See Fungus.)

MYOLOGY. An account of the muscles of the body.

MYOPS. Shortsightedness.

MYRIAMETER. Ten thousand metres, equal to two leagues.

MYRICIN. That portion of wax which is insoluble in alcohol.

MYRISTICACEÆ. A family of tropical trees, exogens, containing the nutmeg. Nearly allied to the laurels.

MYRONIC ACID, MYRONATES. An acid existing in cruciferous seeds, and containing sulphur.

MYROBALANS. A bitter, austere fruit, used in India in calico dyeing and medicine.

MYROSYNE. A substance resembling emulsin, or caseum, in mustard seeds.

MYRRH. An odoriferous gum resin imported from the East. Sweet cicely is sometimes called by this name.

MYRTACEÆ. A family of small trees and shrubs, particularly developed in tropical climates, and yielding the pimento, cloves, guava, cajeput, and other aromatic products.

MYRTLE. *Myrtus.* There are eleven principal species, and many varieties. They are mostly green-house and hot-house evergreen shrubs. *Myrtus communis* is the common myrtle. The myrtle bilberry is a whortleberry, *Vaccinium myrtillus.* Sweet Gale or Dutch Myrtle (*Myrica gale*) is the bayberry, or wax myrtle.

N

NACREOUS. Reflecting iridescent light, like pearl.

NACRITE. A pearly mineral. Silicate of alumina and potash.

NÆVUS. A natural mark, blotch on the skin.

NAG. A small horse.

NAILS. The horny extremities modified into claws, talons, hoofs, etc. They are of the same composition as hair, 100 pounds during decomposition yield twenty pounds of ammonia. The composition of horn, gives, of nails, hoofs, etc., fifty-two carbon, 6.7 hydrogen, 17.3 nitrogen, twenty-four oxygen and sulphur, with less than one per cent. ashes, in 100 parts.

NAKED. In botany, without the customary covering, as a stem without leaves, corolla without calyx, etc.

NAPHTHA. A highly inflammable fluid, of a peculiar odor, specific gravity 0.75, which exudes from the earth in some places. A similar fluid is distilled from wood tar, and called wood naphtha. It is used as a solvent of India rubber, and for other purposes. Petroleum is identical in its composition.

NAPHTHALINE. A white crystalline, volatile product of the destructive distillation of pit coal. Naphthalic acid, naphthalamide, etc., are derivatives.

NAPIFORM. Formed like a turnip, tuberous. Swelled in the upper part.

NARCEIA. A vegetable alkaloid from opium, producing salts of a blue color.

NARCISSUS. Ornamental bulbous rooted flowers, hardy, and blooming in the spring.

NARCOTICS. Anodynes. All drugs which produce sleep, drowsiness, and allay pain, as opium, henbane, tobacco, camphor, stramonium, and other plant extracts.

NARES. The nostrils.

NARRAGANSETT PACERS. This wonderful breed of saddle horses seems now entirely extinct. A century ago, and up to the early years of the present century, it was one of the most valued and distinct breeds of horses in New England. These horses are said to have been of Andalusian origin, of fair size, of fine carriage, and natural and easy pacers. That is their mode of traveling was to pick up both feet on a side squarely and alternately. Rhode Island has the credit of having raised these admirable saddle horses in the greatest numbers, and for a long time large numbers of them were shipped to the West Indies. As roads improved in the United States, and in the West Indies, the demand for them became less and less, and although they have exercised a considerable influence in the formation of the horse stock of New England, as a distinct breed, the Narragansett Pacer is no longer to be found.

NASCENT. In the act of being produced or evolved. A chemical phrase given to the evolution of gases from fluids, at which time they are more fitted to unite with other bodies. Hydrogen, nitrogen, and other gases, in the aëriform state, combined only slowly with substances, but when nascent enters readily into union.

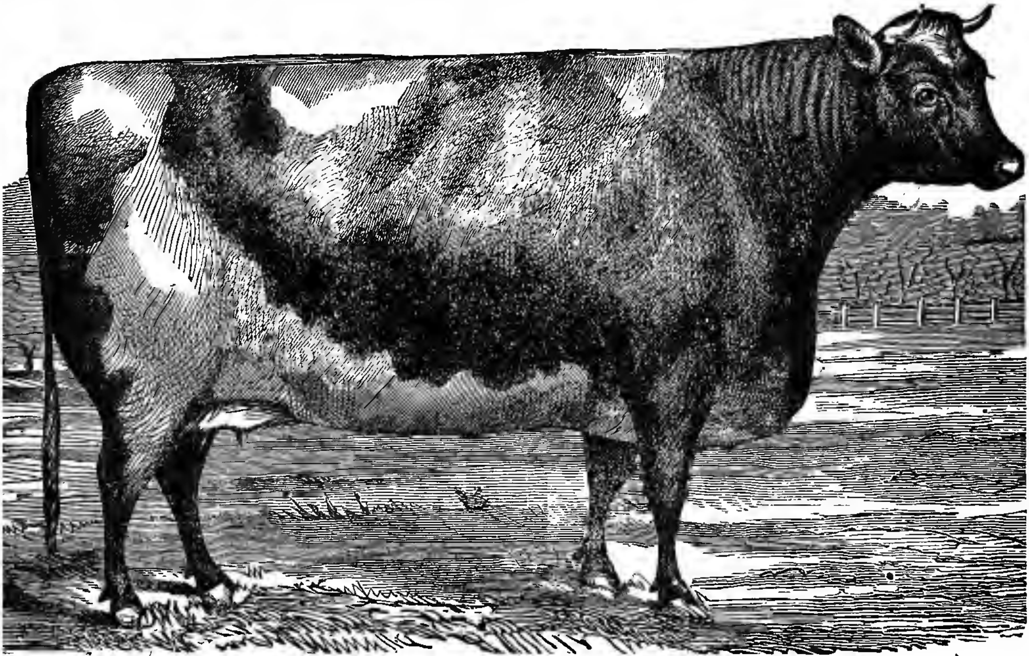
NASTURTIUM. (See Cress.)

NASUTA. A prolongation of the muzzle into the form of a nose.

NATANS, NATANT. Floating or swimming.

NATATORY. In zoology, when the feet or tail are provided with a membrane or hairs to repel or displace water, and buoy up the insect or animal.

NATIVE CATTLE. The genus *Bos* is not native to either North or South America. They were originally brought here by the early Spanish adventurers, and escaping domestication, became semi-wild, and increased to such numbers on the vast plains of Texas, Mexico, California, and the pampas of South America, that they were slaughtered simply for the value of their hides and tallow. The so-called native cattle of America, therefore, are the mixed descendants of the various breeds brought hither from time to time. The Spanish type being preserved in all the country south of Texas, in North America, and in South America; and in the Northern United States the characteristics of the better breeds, as the Devon, Hereford, old Durham, Galloway, and Dutch cattle prevailing, according to the locality. In the New England States, resolving themselves into the New England reds, from the strong infusion of Devon and Sussex blood, producing cattle admirably adapted to the yoke, and for subsisting in that hilly country. In the West and the border States of the South, the strong infusion of the old Durham or Teeswater is as clearly seen, which many years



SHORT HORN COW.

ago even made this region famous for the superior quality of the native beef. In the Middle States the breeds were more mixed up, and in their descendants may be traced various breeds we have mentioned. And it was not unusual to find many polled cattle thirty or forty years ago, and which were especially prized for their milking qualities. The history of the introduction of cattle into the New England States shows that the earliest cattle introduced to Plymouth, and the first in New England, were brought in 1624. In 1631 these are mentioned in the old records as having greatly increased. In the meantime a number had been imported for the colonists at Salem. In 1632 and 1633 Captain John Mason, who with Gorges had obtained large tracts of land on the Piscataqua river, made several importations, in his commerce with Denmark, of Danish cattle and horses, which subsequently became largely diffused over the country. These Danish cattle are described in the old records as large, coarse, and of a yellowish color, and it is supposed that they were obtained by Mason as being well able to endure the hardships to which they would be subjected. They were soon spread among the colonists of Massachusetts bay, and have, undoubtedly, left their marks on the stock of New England, and are discernible even to the present day, mixed with a great variety of crosses with the Devons, the black cattle of Wales, the Danes, and Holland, and the various other English breeds then unimproved. These New England cattle make excellent working oxen, being hardy, docile, easily broken to the yoke, and having a tendency to fatten when well fed, while the cows are often superior milkers. Sixty years ago one of the most intelligent, earnest, and liberal importers and breeders of stock in this country, wrote of the native cattle of New England as follows: I am not satisfied that the delicate Devons are any better suited to the yoke than the vigorous and spirited bullocks which are found in Massachusetts and Maine. It has been asserted, and by authority which I am always disposed to respect, that the cattle of Massachusetts are derived from the Devons; but Lancashire, Leicester, and Hereford blood can be traced by a practiced eye in many of the best working oxen exhibited at the New England agricultural shows. ' If color determines the question, it is but fair to state that from 100 yokes of the finest draft cattle of Massachusetts, which were exhibited in 1822 at the Worcester county show, the best were taken to Brighton, where a pair of very light yellow oxen received a premium for docility and speed at the plow. On a former occasion a yoke of black and white bullocks received the award. The most hardy, active cattle had the shape of kyloes, and were brown. In activity, patience, and strength the cattle of Great Britain have never surpassed the cattle of New England. At the present day the native cattle of the North and West (except in the more primitive districts), are made up of crosses of all the better breeds that from time to time have been imported from England. In fact, in wide districts, scarcely any inferior cattle can be found, the most of them being good grades, hence mixed breeds would be a better name. The Texans (see cut) are really the only native cattle of the United States, and these only as having bred in a wild, or semi-wild state since their escape from the Spanish adventurers.

NATROLITE. A fibrous, yellowish mineral. Silicate of alumina and soda.

NATRON. Soda. Impure, native sesquicarbonate of soda.

NATURAL HISTORY. A description of natural objects, as animals, plants, insects, fishes, minerals and fossils.

NATURAL ORDER OF PLANTS. Groups of plants having a close similarity in internal organization, and frequently in external characters and properties.

NATURAL PHILOSOPHY. Physics, mechanical philosophy. The science which investigates the mechanical laws of nature; and the relations of weight, movement, pressure, or of mechanical forces in masses.

NAUCA. A seed in which the scar of the hilum occupies a third of the surface.

NAUSEA. A feeling similar to that preceding the act of vomiting.

NAVE OF A WHEEL. The hub, the block in the center of the spokes, which receives them.

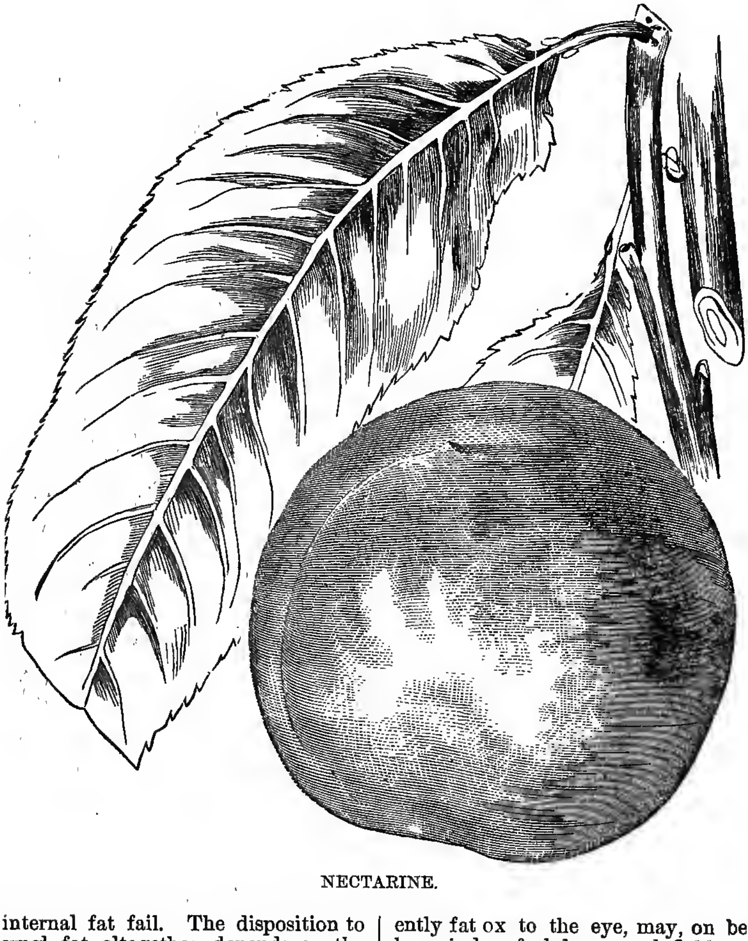
NAVEL-WORT. *Hydrocotyle umbellata.*

NAVEW. *Brassica campestris.* The wild plant is a native of England; in the cultivated form it is known as colza and rape.

NAVICULAR. Having the figure of a boat. It is applied to the nut bone of the foot, as well as to the form of seeds, etc.

NAVICULAR DISEASE. This disease is known also as contraction of the feet, and produces the peculiar crippled gait known as grogginess. The intense agony of the suffering animal may be partially imagined by any person, who, from a boot which contracting on the foot, has doubled the edges together on themselves. When the disease has progressed for some time common humanity would seem to dictate that the animal be killed, to end its misery. If taken early in the disease, care may result in a cure, with only more or less lameness. The disease is most common in horses, driven fast on hard roads, or those used for racing and leaping. It may be sudden in its attacks or be preceded by pointing the toe, and a peculiar tripping gait. Wasting of the muscles of the shoulders is generally present from the fact of disease, and not that there is sweeny there as many ignorantly suppose. The foot will be found dry, hot, and generally tender at some point. At the first sign of the peculiar lameness, take off the shoe, bleed from the artery above the coronet, give the foot a cold water bath for a few hours of the day and poultice at night, (bread and milk or linseed meal). If the inflammation does not yield in two weeks, blister the coronet, and if the disease is still obstinate, a seton may be put in the frog, by paring down thin, using a sharp pointed, short, stout, curved seton needle, the point of the needle entering an inch from the toe and brought out midway between the bulbs of the frog and the forward part of the hollow of the heel; taking care not to go so deep as to interfere with the sinew. Tie the ends of the tape with which the needle is armed, and dress it daily for a month with one part of powdered cantharides to eight parts each of oil of turpentine and Canada balsam. If this does not cure give the horse rest and quiet until the disease runs its course, when he may be able to do some light work.

NEAT CATTLE. The term neat cattle is generally accepted as implying all breeds of the ox tribe domesticated by man. They are therefore as diverse in their characteristics as the nations and peoples who have bred them. In England, the United States and in Canada, they may be said to be bred to the most profitable use as they have been to the highest practical type of excellence in the various breeds for beef, labor and milk. The judging of cattle is a fine art only to be acquired by intelligent thought and practice. There are judges so acute and critical, that by the touch, and other external signs, will judge of the live weight, dead weight of quarters, and tallow within a very few pounds. Yet, to the average farmer it would be mere guess work, and as liable to error on one side as the other. An acute and critical breeder upon the subject of judging cattle has said, were an ox of fine symmetry and high condition placed before a person not a judge of live stock, his opinion of its excellencies would be derived from a very limited view, and consequently from only a few of its qualities. He might observe and admire the beautiful outline of its figure, for that might strike the most casual observer. He might be pleased with the tint of its colors, the plumpness of its body, and the smoothness and glossiness of its skin. He might be even delighted with the gentle and complacent expression of its countenance. All these properties he might judge of by the eye alone. On touching the animal with the hand, he could feel the softness of its body, occasioned by the fatness of the flesh. But no man, not a judge, could rightly criticise the properties of an ox further. He could not possibly discover, without tuition, those properties which had chiefly conduced to produce the high condition in which he saw the ox. He would hardly believe that a judge could ascertain, merely by the eye, from its general aspect, whether the ox were in good or bad health—from the color of its skin, whether it were of a pure or cross breed—from the expression of its countenance, whether it were a quiet feeder—and from the nature of its flesh, whether it had arrived at maturity or not. The discoveries made by the hand of a judge might even stagger his belief. He could scarcely conceive that that hand could feel a hidden property—the touch—which of all tests is the most surely indicative of fine quality of flesh, and of disposition to fatten. It can feel whether that flesh is of the most valuable kind; and with decided accuracy foretell the probable abundance of fat in the interior of the carcase. In short, a judge alone can discriminate between the relative values of the different points, or appreciate the aggregate values of all the properties of an ox. The parts of the ox by which it is judged, let it be remembered, are called points. Thus it may be seen that a person even totally ignorant of cattle may judge of some of the most apparent properties, or points, of a fat ox; but were a lean one placed before him, he would be quite at a loss what opinion to pass on its present, and far more of its future, condition. The outline of its figure would to him appear rugged and angular, and consequently coarse. To him the body would feel as a number of hard bones, covered with a tough skin and coarse hair. A judge, on the other hand, could at once discover the good or the bad points of a lean as well as of a fat ox; because the properties of the former are the same in kind, though not in degree, as those of the latter; and, in accordance with the qualities of these points, he could anticipate the future condition of the lean ox, save and excepting the effects of accidents and disease. But, it may be asked, if the qualifications of a judge of cattle may be so easily acquired as is here represented, how is it that the opinion of a judge is always held in deference, and is always referred to in cases of difference of opinion? This question admits of a very satisfactory answer: Errors in the judging of cattle arise not so frequently from not knowing the points to be judged of, as from judges attributing to one or more of their favorite points too great an influence over the future increasing condition of the ox; and as long as there are so many points to be considered, and as most of them may be partially altered by local circumstances, a difference of opinion may exist among judges of lean stock. Now, what are those points of an ox, a thorough knowledge of which is so essential to constitute a perfect judge? Could they be described and illustrated with such precision as that they might be applied at once to every ox, in whatever condition he might be, a great advancement would be made towards establishing fixed rules for the right judging of all the domestic animals. Fortunately, nature has herself furnished rules for ascertaining points for judgment, a knowledge of which can nevertheless be only acquired by careful observation and long and constant practice. The first point to be ascertained in examining an ox is the purity of its breed, whatever that breed may be, which may be ascertained from several marks. The color or colors of the skin of a pure breed of cattle, whatever those colors are, are always definite. The color of the bald skin on the nose, and around the eyes, is always definite, and without spots. This last is an essential point. When horns exist, they should be smooth, small, tapering, and sharp-pointed, long or short, according to the breed, and of a light color throughout in some breeds, and tipped with black in others. The shape of the horn, however, is a less essential point than the color. The second point to be ascertained in an ox is the form of its carcase. It is found that the nearer the section of the frame of a fat ox, taken longitudinally vertical, transversely vertical, and horizontally, approaches to the figure of a parallelogram, the greater quantity of flesh will it carry within the same measurement. That the carcase may fill up the parallelogram as well as its rounded form is capable of filling up a right-angled figure, it should possess the following configuration: The back should be straight from the top of the shoulder to the tail. The tail should fall perpendicularly from the line of the back. The buttocks and twist should be well filled out. The brisket should project to a line dropped from the middle of the neck. The belly should be straight longitudinally, and round laterally, and filled at the flanks. The ribs should be round, and should project horizontally, and at right angles to the back. The hooks should be wide and flat; and the rump, from the tail to the hooks, should also be flat and well filled. The quarter from the aitch-bone to the hook should be long. The loin bones should be long, broad and flat, and well filled; but the space between the hooks and the short-ribs should be rather short, and well arched over with a thickness of beef between the hooks. A long hollow from the hooks to the short-ribs indicates a weak constitution, and an indifferent thriver. From the loin to the shoulder-blade should be nearly of one breadth, and thence it should taper a little to the front of the shoulder. The neck-vein should be well filled forward, to complete the line from the neck to the brisket. The covering on the shoulder-blade should be as full out as the buttocks. The middle ribs should be well filled, to complete the line from the shoulders to the buttocks along the projection of the outside of the ribs. These constitute all the points which are essential to a fat ox, and which it is the business of the judge to know, and by which he must anticipate what the lean one, when fed, would realize. The remaining points are more applicable in judging of a lean than a fat ox. The first of the points in judging of a lean ox is the nature of the bone. A round, thick bone indicates both a slow feeder, and an inferior description of flesh. A flat bone, when seen on a side view, and narrow, when viewed either from behind or before the animal, indicates the opposite properties of a round bone. The whole bones of the carcase should bear a small proportion in bulk and weight to the flesh, the bones being only required as a support to the flesh. The texture of the bone should be small-grained and hard. The bones of the head should be fine and clean, and only covered with skin and muscle, and not with lumps of fat and flesh, which always give a heavy-headed, dull appearance to an ox. The fore-arm and hock should also be clean and full of muscle, to endure traveling. Large joints indicate bad feeders. The neck of an ox should be, contrary to that of the sheep, small from the back of the head to the middle of the neck. The reason of the difference, in this respect, between the ox and the sheep is, that the state of the neck of the ox has no effect on the strength of the spine. A full, clear and prominent eye is another point to be considered; because it is a nice indication of good breeding. It is always attendant on fine bone. The expression of the eye is an excellent index of many properties in the ox. A dull, heavy eye certainly indicates a slow feeder. A rolling eye, showing much white, expresses a restless, capricious disposition, which is incompatible with quiet feeding. A calm, complacent expression of eye and face is strongly indicative of a sweet and patient disposition, and, of course, kindly feeding. The eye is frequently a faithful index to the state of the health. A cheerful, clear eye accompanies good health; a constantly dull one proves the probable existence of some internal lingering disease. The dullness of eye, arising from the effect of internal disease, is, however, quite different in character from a natural or constitutional phlegmatic dullness. The state of the skin is the next point to be ascertained. The skin affords what is technically and emphatically called the touch—a criterion second to none in judging of the feeding properties of an ox. The touch may be good or bad, fine or harsh, or, as it is often termed, hard or mellow. A thick, firm skin, which is generally covered with a thickset, hard, short hair, always touches hard, and indicates a bad feeder. A thin, meagre, papery skin, covered with thin silky hair, being the opposite of that just described, does not, however, afford a good touch. Such a skin is indicative of weakness of constitution, though of good feeding properties. A perfect touch will be found with a thick, loose skin, floating, as it were, on a layer of soft fat, yielding to the least pressure, and springing back toward the fingers like a piece of soft, thick chamois leather, and covered with thick, glossy, soft hair. Such a collection of hair looks rich and beautiful, and seems warm and comfortable to the animal. It is not unlike a bed of fine, soft moss, and hence such a skin is frequently styled mossy. The sensation derived from feeling a fine touch is pleasurable, and even delightful, to an amateur of breeding. Along with it is generally associated a fine symmetrical form. A knowledge of touch can only be acquired by long practice; but, after it is once acquired, it is of itself a sufficient means of judging of the feeding qualities of the ox; because, when present, the properties of symmetrical form, fine bone, good disposition, and a purity of blood, are the general accompaniments. These are the essential points of judging lean cattle; but there are other and important considerations which must claim the attention of the judge, in forming a thorough judgment of the ox. The proportion which the extremities bear to the body and to each other, is one of these considerations. The head of the ox should be small; and set on the neck as if it appeared to be easily carried by the animal. This consideration is of great importance in showing cattle to advantage in the market. The face should be long from the eyes to the point of the nose. No face can be handsome without this feature. The skull should be broad across the eyes, and only contract a little above them, but should taper considerably below them to the nose. The muzzle should be fine and small, and the nostrils capacious. The crown of the head should be flat and strong, and the horns should protrude horizontally from both sides of it, though the direction of the growth from the middle to the tip varies in the different breeds. The ears should not be large, but should stand a little erect, and be so thin as to appear translucent when exposed to the sun. The neck should be light, tapering from the front of the shoulder and neck-vein, with a gradual rise from the top of the shoulder to the head. The length of the neck should be in proportion to the other parts of the animal; but this is a non-essential point, though an apparently short neck would be preferred to a long one, because it is generally well covered with the neck-vein. A droop of the neck, from the top of the shoulder to the head, indicates a weakness of constitution, arising frequently from breeding too near akin. The legs, below the knee, should be rather short than long, and clean made. They should be placed where they apparently bear the weight of the body most easily, and should stand wide asunder. The tail should be rather thick than otherwise, as thickness indicates a strong spine and a good weigher. It should be provided with a large tuft of long hair. The position of the flesh on the carcase is another great consideration in judging of the ox, the flesh on the different parts being of various qualities. Those parts called the spare-rib, fore and middle ribs, loins, and the rump or hook-bone, are of the finest quality, and are generally used for roasts and steaks. Consequently, the ox which carries the largest quantity of beef on these points is the most valuable. Flesh of fine quality is actually of a finer texture in the fiber than coarse flesh. It also contains fat in the tissue between the fibers. This arrangement of the fat and lean gives a richness and delicacy to the flesh. The other parts, though not all of the same quality, are used for salting and making soups, and do not command so high a price as the parts just described. A full twist, lining the division between the hams, called the closing, with a thick layer of fat, a thick flank, and a full neck-vein, are generally indicative of tallow in the interior of the carcase; but it frequently happens that all these symptoms of laying on internal fat fail. The disposition to lay on internal fat altogether depends on the nature of the individual constitution; for it is often observed that those animals which exhibit great fattening points on the exterior do not fill with internal fat so well as others which want these points. On the contrary, thin-made oxen, with flat ribs, and large bellies, very frequently produce large quantities of internal fat. The first part which shows the fat in a feeding ox, is the point or top of the rump, which, in high-bred animals, is a prominent point; sometimes it protrudes too much, as the mass of fat laid on these is out of proportion to the lean, and therefore useless to the consumer. This is the part which frequently misleads inexperienced judges in the true fatness of the ox, because fat may be felt on this part when it is very deficient on most of the other points. The parts, on the other hand, which are generally the last in being covered with flesh, are the point of the shoulder joint, and the top of the shoulder. If these parts are, therefore, felt to be well covered, the other and better parts of the animal may be considered ripe. Ripeness of condition, however, can only be rightly ascertained by handling, for there is a great difference between the apparent and real fatness of an ox. The flesh of an apparently fat ox to the eye, may, on being handled by a judge, feel loose and flabby; but a truly fat ox always feels hard fat. With such, the butcher is seldom deceived, while loose handlers give no assurance of killing well.



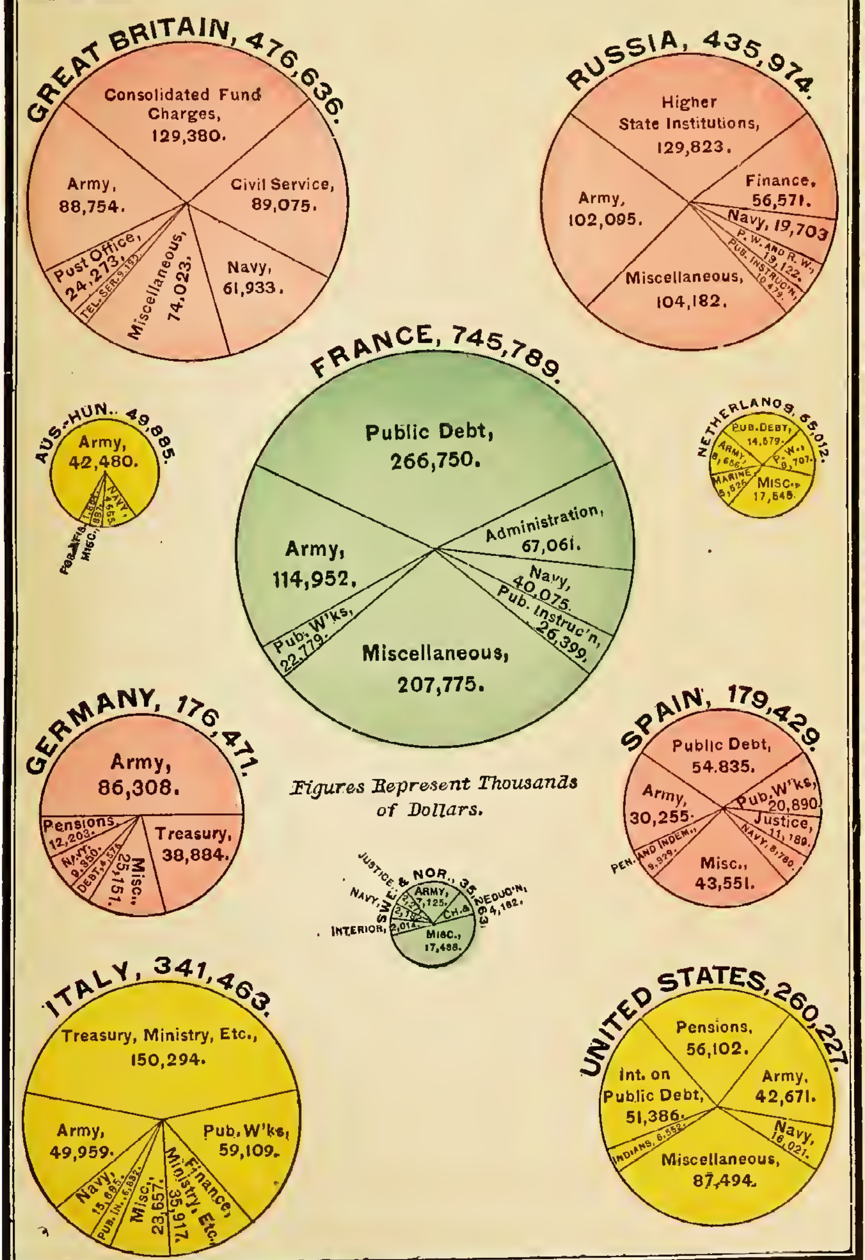
NECTARINE.

NEAT'S-FOOT OIL. The fat obtained by boiling feet of cattle.

NEBULA. A cluster of small stars appearing like a minute cloud.

NECK, COLLAR. In plants, the space between the stem and roots, often swollen in size. The neck of a capital is the space above the shaft between the ring (*annulet*) above, and the astragal at the top of the shaft.

CLASSIFIED EXPENDITURE OF NATIONS.



Figures Represent Thousands of Dollars.

NECROPHAGANS, NECROPHAGA. A family of clavicorn beetles, some of which live on decomposing animal matters.

NECROSIS. A disease resembling mortification of the bony structures. In plants, the term means the rotting of the part.

NECTARY, NECTARIUM. The part of a flower which secretes honey. It is usually an appendage of the petals or disk.

NECTARINE. *Persica Vulgaris* (var). The nectarine is a variety of the peach, having a smooth skin. In India its name signifies smooth peach. The history of its origin is not certainly known, but that it is an accidental variety or sport, is made pretty certain from the fact that both peaches and nectarines have frequently been borne on the same branch. Nectarine seeds, however, produce nectarines, though occasionally the peach is produced from a nectarine seed, and vice versa. The nectarine is but little cultivated in the United States. It is shy in bearing and like all smooth stone fruits, especially liable to the attacks of the curculio. The tree is treated precisely as the peach, and its habits and hardiness are the same. There are both free stone and cling varieties. If the cultivation of this fruit is attempted, the branches should be annually shortened in and the fruit carefully watched for the curculio, and the insects regularly jarred upon a sheet from the time the fruit is the size of a hazel nut until fully grown. The cut will show the characteristics of fruit and leaf. The following is the list recommended by the United States Pomological Society, as lately revised: 1, Boston; 2, Downton; 3, Early Newington; 4, Early Violet; 5, Elruge; 6, Stanwick. The whole list is marked for New York and Michigan. 1 and 3 are of American origin, 1 being the seedling of a peach. 1 and 6 recommended for Maryland; 3 for Tennessee, and as being of superior value there; 4 and 5 for Indiana, 5 also for Pennsylvania and Missouri.

NEGATIVE SIGN. Minus, or —. It is employed to denote quantities or measures below a standard.

NEGUNDO. (See Maple.)

NELUMBIUM. A marsh or water plant, the seeds of which, of the size of an acorn, are eaten green; or preserved as sweetmeats, and have a nutty flavor. The succulent roots are also eaten raw or boiled.

NEMOCERA. A family of diptera, with filiform antennæ.

NEMOGLOSSATA. The bee tribe, and those hymenoptera which have a long, thread-like tongue.

NEMOROSE, NEMOROSA. Belonging to the woods.

NEPHRITE. A tough, greenish mineral, used to manufacture ornaments. A silicate of alumina and magnesia with iron.

NEPHRITIS. Inflammation of the kidney.

NEPTUANIAN THEORY. The theory of Werner, that geological formations were due to aqueous causes.

NERIUM. A genus of important Eastern plants. *N. antidysentericum* affords the codaga bark; *N. tinctorium*, a beautiful evergreen of India, affords some indigo from its leaves.

NEROLI, OIL OF. The distilled essential oils of orange flowers.

NERVES. The white, thread-like fibers, which, proceeding from the brain or spinal marrow, ramify throughout every part of the bodies of the higher animals. They convey impressions from and to the brain, preside over the functions of the different organs, and regulate motion and the senses. Nerves can hardly be said to be absent in any animals, although they become extremely rudimentary in many. Chemically, nervous matter consists of seven parts albumen, five fatty matter, and eighty water. The fat is peculiar, containing phosphorus. Most diseases affecting the whole body are accompanied, or commence in an impaired state of the nervous system, which presides over health. Nerves are said to be cerebral when they proceed directly from the brain; there are nine pairs of these, and they preside over the senses. The nerves arising from the spinal marrow are termed spinal nerves, and divided into cervical, dorsal, lumbar, and sacral. They preside over motion and ordinary sensation, as well as the functions of the lungs, stomach, liver, and other viscera. The great sympathetic nerve is a series of junctions between the spinal nerves, and is connected with the brain; in its course, small masses of a reddish color occur, called ganglions: it renders the functions of the different organs uniform. A plexus of nerves is a net-work formed by the union of various filaments. Nerves, or Nervures, in plants, are the ramifications of woody tissue and vessels seen upon leaves, flowers, etc. They support the cellular tissue of the leaves.

NETTED. Reticulated, marked like the meshes of a net.

NETTLE. *Urtica.* A class of plants noted for their stinging hairs, and named from the Latin *uro*, to burn. The more common species, are *U. gracilis*, the tall, wild nettle, growing from two to six feet high, and found generally in the North. It has scarcely any stinging hairs except on the petioles, and sparingly on the principal veins. *U. dioica*, is the great stinging nettle, growing two to three feet high, naturalized from Europe, very bristling and stinging; more common East than West, and found growing in waste places, *U. urens* is the small stinging nettle, also of European origin, growing one foot high. *U. purpurascens* has a slender stem, one to three feet high, carrying, in common with the leaf stalk, scattered stinging bristles, common in alluvial lands, Kentucky and South.

NETTLE-TREE. The genus *Celtis*, amentaceous trees. The principal American species is the *C. occidentalis*, the sugar or pompion berry. It is seldom twenty feet in the Middle States, but becomes seventy in the South. It is ornamental with small, white flowers, and sweet, reddish fruit.

NEURALGIA. Pain of the nerves.

NEURILEMA. The covering of the nerves.

NEUROPTERA. Insects with four netted wings.

NEUTERS. Infertile animals or plants, having neither stamens nor pistils.

NEUTRAL, NEUTRALIZATION, NEUTRALIZED. The combination of an acid with an alkali, or of two active bodies together, by which the properties of either are perfectly destroyed. The addition must be made in the proportion of their equivalents to produce neutral compounds.

NEUTRAL SALTS. Salts which betray neither an acid nor alkaline reaction.

NEWEL. In building, the space around which a flight of steps is turned.

NEW JERSEY TEA. *Ceanothus Americana.* A common marsh shrub with fragrant bunches of flowers; some used as a substitute for tea.

NEW RED SANDSTONE. The series of strata lying immediately above the coal formation. It consists of conglomerates, and contains marl, gypsum, and large quantities of rock salt.

NICARAGUA WOOD. The dye-wood of *Cæsalpina echinata,* a tree of South America.

NICHE. A recess in a wall for a statue.

NICKEL. A rare white metal, like iron. Its salts are green for the most part. It exists in meteoric stones.

NICKING AND DOCKING. Pricking. Cutting off part of a horse's tail, and making nicks on the under side, to divide the two cords, which draw down the tail. It is now in disuse.

NICOTIANIN. A fatty, volatile, azotized body, insoluble in water, formed during the fermentation of tobacco in preparing for the market, and to which its odor is due. It is poisonous, especially to insects and reptiles.

NICOTIN, NICOTINA. An acrid, soluble, volatile alkaloid found in tobacco. It combines with acids, and forms salts. It is very poisonous.

NICTITATION. Winking. The movement of the membrane covering the eyes of birds and some animals, called the *membrana nictitans.*

NIDUS. A nest. A suitable position or matrix for development. *Nidulus* and *nidulate* are derivatives.

NIGER. Black. *Nigrescent,* growing black. *Nigricans,* blackish, sooty.

NIGHT HAWK. An insectivorous bird of the family *caprimulgidæ,* so named from their supposed habit of goat sucking. Our night hawk, *Chordeiles popetue,* is wholly insectivorous, feeding entirely on insects, especially the coleoptera; also moths, caterpillars, crickets and grasshoppers. It is strictly nocturnal, but is sometimes seen pursuing its prey in dark, cloudy days. The whip-poor-will, *Antrostomus vociferus,* is also nocturnal, feeding on moths, beetles and other night flying insects; not, as is generally supposed, upon minute insects, as midges, but on the larger noxious insects. In fact its food is pretty much the same as the night-hawk, and both should be sedulously protected.

NIGHT SHADE. A common plant. *Solanum nigrum.* An annual plant, low spreading, and much branched; flowers quite small, white, and the berries globular and black. Said to be poisonous. A plant naturalized from Europe, growing in shaded grounds and fields. It should be eradicated wherever found.

NIGHT SOIL. The contents of privies, a a mixture of urine and fæces. It was formerly supposed to be the most valuable of manures, and in the neighborhood of cities is largely manufactured by desiccating with earth into poudrette. More recently it has been found that the urine contained forms the chief constituent of value, this being one of the most powerful of manurial substances; to make poudrette at home all that is necessary, is to have the privy so constructed that the contents may be easily removed. Mix the contents with air-dried muck, or strong loam, under cover, using also the chamber lye daily carried out; as the mass becomes dry, it may be used again and again, with the contents of the privy, until it is well saturated with the nitrogen and other salts. In this form it becomes a powerful special manure. Green vitriol may be used in the privy to deodorize and fix the ammonia, and gypsum and charcoal dust, will be found valuable with the dry muck, as a desiccator.

NIMBUS. The rain cloud. It is black and near the earth.

NIPPERS. The four front teeth of the horse. The permanent ones appear between the second and third years. Pincers, forceps. (See article Horse.)

NIPPLE. A conical elevation. The extremities of the udder. Teats.

NITIDUS. Shining, polished, smooth.

NITRATE OF SILVER. In the fused state this is called lunar caustic, and much used as a caustic. It consists of one equivalent of nitric acid united with one of oxide of silver. A solution is used in the laboratory to detect the presence of muriatic acid and chlorine in solutions, with both of which it forms a white, curdy precipitate. It is also a test for organized matter, becoming black in its presence.

NITRATES. Salts containing nitric acid combined with a base, as nitrate of potash, soda, lime, ammonia.

NITRE. Saltpetre, nitrate of potash. A compound of fifty-four parts (one equivalent) of nitric acid with one equivalent, or forty-eight parts potash. It crystallizes in six sided prisms, with two faces at the summits; is soluble in seven parts cold, and less than its weight of hot water.

NITRE, CUBIC. Nitrate of soda. It consists of one equivalent nitric acid, and one soda; is crystallized in rhomboids; is very soluble and deliquescent, requiring but three parts water, at 60° Fahrenheit, for solution. The great part of the salt in commerce is derived from Peru, where immense deposits of it occur

NITRIC ACID. Aquafortis. The pure acid is unknown, that of the shops being a solution in water; the strongest specimens have a specific gravity of 1.5 and contain one atom of acid with two of water; it is of a yellowish tinge, smokes, and is extremely caustic, dissolving most metals. The pure acid consists of one atom of nitrogen with five of oxygen. Nitric acid is extensively employed in the laboratory as a solvent, and, from its active action on many compounds, it readily parts with a portion of its oxygen, oxidizing organic and other bodies presented to it. Its salts are soluble in water, and decrepitate on hot coals.

NITRO. A prefix to the name of bodies containing nitric acid or nitrogen.

NITROGEN. Azote, so called from its fatal effects on life when breathed, in an uncombined state. Hydrogen forms about seventy-nine parts in the one hundred parts of air. In combination with oxygen, it forms nitric acid. Combined with hydrogen it forms ammonia. In combination with oxygen it is the source of nitrogenous compounds in animals and plants; pure nitrogen is a colorless gas devoid of taste and smell. Thus we see that the air is the source of this necessary ingredient in plants and yet it is locked up, so far as the artificial elimination of it is concerned, at least from an economical point of view. In the state in which nitrogen exists in the air, it can not be assimilated by plants except through its foliage. Its only source to plants being through the roots either from geine, from ammonia, or from the nitrates, through decomposition by the action of the growing plant. It has indeed been held that plants take up nitrogen, from the air by their leaves. There is however, no real proof that such is actually the fact. Nitre consists of an alkali united to an acid composed of one part of nitrogen to five of oxygen is in fact nitrate of potash. The nitrates of potash, soda, magnesia and lime are natural products. The nitrates of oxides, and of metals are artificial products. The nitrates undergo decomposition at a high heat, thus they are converted into free nitric acid and the oxidized base, or into oxygen which escapes, and into nitrous acid, which remains in combination with the base forming a nitrite. In the laboratory it is easy to produce nitrogen The air is simply to be deprived of its oxygen. It may be done in various ways, either by leaving a piece of phosphorus several days in a bell glass over water, or by burning phosphorus in the glass standing over water, or by passing air through a tube partly filled with copper shavings, heated to a red heat. Nitric acid is the most important product of nitrogen, and the agent from which the other compounds are produced. Nitric acid when pure, occurs in brilliant transparent crystals, its composition in 100 parts being nitrogen twenty-six, and oxygen seventy-four parts. In commerce it is only found mixed with water, its most concentrated form, that of fuming acid being 85.72 parts of anhydrous acid 13.28 of water. Its most usual form in commerce is sixty per cent. of pure acid and forty per cent. of water. It is, however, of various degrees of strength, often containing two-thirds of water. Nitrous acid is an unstable compound giving off deep red fumes. It is generated by the action of dilute nitric acid upon copper shavings, deutoxide or nitric oxide being first formed which, exposed to the air, absorbs more oxygen. The lowest oxide of nitrogen is the protoxide or nitrous oxide. It has a sweet taste but no odor or color. Ammonia, one of the more important compounds of nitrogen is an inflammable gas, very pungent to the smell and acrid to the taste. It is readily and abundantly formed by decaying organic bodies, containing nitrogen, for, in the process of decay, the elements of organic matters form new groupings generally simpler than the original substances. Thus a portion of nitrogen associates with a portion of hydrogen, and ammonia is formed. In the case of heating manure, it is the pungent gas. In the decay and decomposition of human urine, carbonate of ammonia is formed. So the carbonate of ammonia is formed in the manufacture of bone black. Commercial ammonia is mostly formed by the distillation of bituminous coal, and is a bye product in making illuminating gas.

NITRO-MURIATIC ACID. *Aqua regia.* A mixture of strong nitric and muriatic acid, whereby chlorine is evolved, which dissolves gold, platinum, and other metals.

NITROUS ACID. A pungent, orange-colored, volatile acid, consisting of one equivalent nitrogen and four oxygen.

NITROUS OXIDE. Protoxide of nitrogen, laughing gas.

NOCTURNAL. Of the night. Many birds and insects prey only at night, hence are nocturnal.

NODE. A knot or lump. A bony tumor. The swelling on the stems of plants where leaves start; also called nodi. A nodal point, in physics, is a place of rest, where several forces counterbalance one another.

NODOSUS. Knotty.

NODULE. Rounded, irregular lumps or masses.

NOGGING. In building, brick-work carried between uprights of timber scantling.

NOMENCLATURE. The language employed in scientific descriptions.

NON-CONDUCTOR. A substance incapable of conducting heat or electricity.

NONESUCH. *Medicago lupulina.* The black medick.

NOOTH'S APPARATUS. A series of three glass vessels, placed vertically, for the purpose of impregnating water with carbonic acid gas. The lower vessel contains the marble and muriatic acid for the evolution of the gas; the central vessel holds the water, under the pressure of the column of water in the third or upper vessel, which is closed by a conical stopper, which serves as a safety-valve.

NOPAL. The *Opuntia cochinillifera,* a cactus on which the cochineal insect lives; native of the sandy tracts of Mexico.

NORDHAUSEN SULPHURIC ACID. Fuming strong acid obtained by the distillation of green vitriol.

NORFOLK POLLED CATTLE. This is a subfamily of the Galloway, that have long since been bred in Norfolk. They are little known in this country, and according to Youatt while they retain much of the general form of their ancestors, the Galloways, they do not retain all their excellencies. They have been enlarged but not improved by a southern climate and a richer soil. They are usually red; some, however, are black, or either of these colors mixed with white, with a characteristic golden circle about the eye. They are taller than the Galloways, but thinner in the chine, flatter in the ribs, longer in the legs, somewhat better milkers, of greater weight when fattened, but not fattening so kindly, and the meat not quite equal in quality.

NORMAL. Regular, straight, usual.

NORMAN HORSE. (See French Horse.)

NORWAY MAPLE. (See Maple.)

NOSE-BAG. A bag containing corn or oats to be tied to the horse's nose.

NOSE-BAND. That part of the headstall of a bridle which comes across the nose.

NOTCHED. Crenate.

NOTCHED-BOARD. In building, the board which receives the ends of the steps of a staircase.

NOVACULITE. Home stone.

NUCLEUS. The point around which crystals or organized structures are developed; the origin. In botany, the upper, pulpy mass of an ovule; the interior of a seed. The shield of lichens.

NUCULA. A fruit like the acorn, or a one-seeded, hard seed-vessel.

NUDUS. Naked.

NURSERY. In horticulture, a nursery is a field or farm used exclusively for the propagation of trees and plants, and the cultivation thereof until they are of sufficient size for transplanting where they are to stand permanently.

Until within the last seventy years but little attention was paid to the rearing of nursery stock for sale, as a special industry, in the United States, and it is only within the last forty or fifty years that the great nurseries East and West have had a beginning. A competent authority states that very little attention was paid to the raising of fruits previous to the Revolution, except for the manufacture of cider. The first apples were raised upon Governor's Island, in the harbor of Boston, from which, on the 10th of October, 1639, ten fair pippins were brought, there being not one apple or pear tree planted in any part of the country but upon that island. The first nursery of young trees in this country was that planted by Governor Endicott on his farm at Salem, now Danvers, in 1640, and it is related that he sold five hundred apple trees for two hundred and fifty acres of land. The systematic cultivation of fruit was not common in this country previous to the Revolution. Orchards were set out upon many farms, but they were designed chiefly for cider. Much greater care, however, was taken to raise good fruits in New York, New Jersey, and Pennsylvania than in New England, and several noted orchards and nurseries existed there in the latter part of the last century and the early part of the present, but they were the exception to the general rule even there. Choice varieties of apples, pears, peaches and cherries were known only to a few careful cultivators, and the number of varieties of these was quite limited as compared with the present day. Cider was plenty, but its quality was much less regarded than its quantity. It is stated that so late as 1825 there was not a nursery for the sale of apple and pear trees in New England. Trees had to be bought in New York or New Jersey, or imported from abroad. The first horticultural society in the country was established in 1829. The orchard products, according to the census of 1870 were $48,000,000, and the general culture of fruit has since rapidly progressed. We have now nurseries established for growing certain given varieties of trees, as forest trees, and even evergreen trees solely. One nursery in Illinois, devoted solely to evergreens, has disposed of over 20,000,000 in one year. As a rule however, the nurseryman grows or deals in a variety of trees and plants, and as in the case of one of the great nurseries of Rochester, N. Y., there is hardly a plant of use or ornament, whether native or exotic, hardy or to be cultivated only under glass, but that may be obtained. The same may be said of one of the great Bloomington, Ill., nurseries. In preparing the nursery grounds, the most important point to be attended to in the West is thorough drainage by means of tile. One of the most successful nurserymen in the West, located at Springfield, Ill., stated to the writer that the measure of his great success was in first thoroughly tiling his land, dry and wet alike, to a depth of three feet. Thus, there are no waste places; there was also no hunting after particular locations for particular plants, no weak places in the rows, and comparatively few inferior or cull stock, and the subsequent expense of cultivation is lightened and the growth forwarded to fully reimburse the interest on the cost of the permanent investment and wear of the drainage, this last being in carefully laid tile hardly to be estimated. It will hardly pay the general farmer to raise his own nursery stock, since he can buy his plants and trees much cheaper than he can grow the seedlings and graft or bud them. The same may be said of ornamental and forest trees, both deciduous and evergreen. In the case, however, where quantities of forest trees, or even where small groves and wind breaks are to be planted, it is altogether better that the trees be bought, quite young, and planted in nursery rows, to remain there until of a size for final transplanting where they are to stand. Thus, seedling conifers from four to twelve inches high, and deciduous trees one or two years old, and nursery stock either recent grafts or of one year's growth, may be ordered and planted out, the evergreens in rows two feet apart and pretty thick in the rows. As they begin to crowd each other in the row, take out every other one until they stand two by two feet. Then take out every other row, and again every other plant in the remaining rows. Those left will make specimen plants for various ornamental purposes. Deciduous seedlings should be planted four feet apart, as to the rows, by twelve inches in the row, thinning out as may be necessary, as heretofore directed Eventually, they may stand sixteen by sixteen feet, and these may be allowed to grow up into a grove, or the wind break may be planted thickly and thinned out as necessary, leaving enough to stand for permanent growth. The idea in all this is that trees and plants while young can be cultivated and taken care of more economically in compact bodies than when planted out at the distances at which they are finally to stand. One plant will also support and act as a nurse to another if not too much crowded. The pruning, pinching, and training is more easily performed, and they may stand in the home nursery much longer and be transplanted far more safely than direct from the commercial nursery rooms, and for the reason that they will not have to be carried long distances. Thus by buying quite young stock (maiden trees) they may stand until quite of large size, four or five years for apples and pears, three to four years for plums and cherries, and be safely transplanted with an abundance of fibrous roots, especially if they have been root-pruned the June previous to being finally transplanted. This is done by thrusting a sharp spade deeply down to cut the leading roots at a distance of eighteen inches to two feet from the stem of the tree, according to size. Thus, they will be found the succeeding spring to be furnished with an abundance of fibrous roots. It would be better that this root pruning be done two years before the final transplanting, when the roots may be cut from fifteen to eighteen inches from the stems of the trees. Thus a five or six year old tree may be transplanted and with ordinary care will scarcely be checked in growth. In relation to the home nursery and training, Dr. Warder, the veteran and venerable pomologist, says: Trimming should be practiced in the nursery with a definite object in view, and not at random; much less with any expectation of increasing the height of the trees by trimming them up. The object in pruning nursery trees should be to develop them in every part, to produce a stout, stocky, sturdy little tree, one that may be turned out upon the bleak prairie, and be able to withstand the blasts. To produce this result, the leaves should never be stripped from the shoots to make them extend their growth, for the sake of making more leaves; the nurseryman should know the value of leaves, as constituting the great evaporating surface that plays a most important part in causing the ascent of the crude sap and also in its elaboration after it has been taken up into the organization of the plant. Leaves should be carefully preserved, and in the trimming, which is necessary, this should be borne in mind. To make vigorous, stocky trees, the side branches should be encouraged rather than pruned off. The tops may sometimes need to be pinched, to force out the laterals, and to encourage their growth; if two shoots start together as rivals, one of them should be topped or cut back, or twisted and broken, but not cut off at its origin, unless there be plenty of lateral branches or twigs to furnish the tree. When these become too long, they may be spurred-in, either in the fall and winter when cutting grafts, or in the summer, during the growing season. Whenever it becomes necessary to trim off any of these laterals, it is best to do it at mid-summer, as the healing of the wounds made at this period is very rapid. Heading off the nursery trees is to force them to branch uniformly the second year, to form their heads at the right place; this is to be done toward spring, and is applicable especially to those varieties that are prone to make a single shoot the first year without branching, and which have not been pinched in or headed during the previous summer to force out side branches. Cherries, plums, and pears, and some apples, are very apt to make this kind of growth. It should have been premised that all nursery trees ought to be grown to one main stem, or leader, from which all the branches arise, and to which they should all be made to contribute their quota of woody fiber. It has been asserted that the wood of a tree, instead of being a cone, as its stem appears to be and is, it should be a column of nearly equal size from the bottom to the top; that is, the mass of all the branches taken together, should equal the diameter of the trunk at any point below. A well-grown, stocky nursery tree, with its abundance of lateral branches approximates this idea; but the main stem of such an one is very perceptibly a cone, rapidly diminishing in diameter from the collar upwards. The age of trees for planting depends so much upon the views of planters, that the nurseryman can not always control the period at which he shall clear a block of trees. Peaches should always be removed at one year from the bud. Plums and dwarf pears will be ready to go off at two years from the bud or graft; so with apples and cherries. But many persons, purchasers and sellers, prefer larger trees, and they recommend that the trees should remain one, two, or even three years longer in the nursery. Others, a new school of planters, prefer to set out the maiden tree, in most of the species above named, except some very feebly growing varieties, that will scarcely have attained sufficient size to risk in the orchard. The nurseryman should beware of keeping his trees too long on his hands; they may become unprofitable stock, and are sure to require much more labor in the digging and handling. The purchaser is his own master, and his tastes and wishes must be consulted; if he wants large trees, by all means let him be indulged; he will have to pay in proportion, he will have more wood for his money, more weight to carry, or more transportation to pay for, more labor in planting, and vastly increased risk of the life of his trees; but, let him be indulged with his five-year-old trees, while his neighbor, for a smaller sum invested, with less freight, less wood, less labor, and infinitely less risk, will plant his maiden trees, and five years after will market more fruit. The nursery orchard, as practiced by A. R. Whitney, of Illinois, one of the largest orchardists of the country, is well worthy of imitation by all those nurserymen, who desire also to become fruit-growers. In laying off the blocks of nursery stock, the varieties that are wanted for the orchard, should be planted in such a manner that they shall be in every fourth row, so that the orchard trees will stand in rows sixteen to twenty feet apart, according as the nursery-rows are four or five feet wide. In cultivating and trimming these rows in the nursery, a plant is selected, every twelve or sixteen feet, which is to remain as the orchard tree when the block shall be cleared. A good tree is selected, and special care in the pruning is bestowed upon it to secure the desired form, and low branches; if necessary, the tree on either side of it is removed, to give it room. By the time the block is cleared, these orchard trees are often in bearing, and while his customers are struggling to save their trees, and nursing them after their transplanting, the nurseryman will have become an orchardist, and is enjoying his fruits. The nursery will have become an orchard — one rather closely planted to be sure—but the trees can be dwarfed by root pruning with the plow, they shelter one another from the prairie blasts, and when too thick, alternate trees may be removed to the wood-pile, and thus cheer the owner on a winter's day. Winter-killing is a serious evil in the nursery, as by it whole rows and blocks of certain varieties are sometimes destroyed, or very seriously injured. It has been observed to be most marked in its effects upon those sorts of trees that make the most vigorous and sappy growth, as well as that class which continue to grow late in the season. Such varieties have very naturally acquired the epithet of tender, especially as orchard trees of the same kinds, even in a bearing state, have been similarly affected; in some sections of the country, these kinds have been thrown out of cultivation. The bark looks shriveled and withered, the twigs seem dry when cut, and resist the knife; when thawed by the fire, or on the return of spring weather, the bark seems loose, and the inner bark, instead of being greenish-white, becomes brown, and the whole tree looks as though it was dead. In old trees, large portions of the bark start from the stem and large limbs, and hang loosely for awhile and then fall off. The buds alone retain their vitality, and upon the return of spring they sometimes succeed in establishing the necessary connection with the soil, and restore the circulation of the sap; the results are the deposit of the usual annular layer of woody matter, which encases the dead portions within, that become like a sequestrum of dead bone in an animal. The best treatment for the trees that have been winter-killed, is to cut them back very severely, in the hope of producing a vigorous wood-growth the next season, to repair the injury. A partial winter-killing often affects small nursery trees, especially on low and wet, undrained soils; the plants recover, but for years they have a black place in the heart which embraces all of the wood-growth that was affected—all their wood at the period of the disaster. This is enclosed and surrounded by clear healthy wood; but such trees are not desirable, they are so fragile, as to be easily broken. The best preventive for winter-killing in the nursery, is to encourage the early ripening of the wood, and to drain the land, is one of the best means of producing this effect, another is the cessation of culture at midsummer, and the sowing of oats very thick at the last cultivation, has been practiced, and, it is thought, with excellent effects. The rank growth absorbs the superfluous moisture, robbing the trees, and afterward forms a good protective mulch during the winter. The objections to it are, that it encourages the mice, which, by girdling the trees, effectually winter-kills them. Many nursery and orchard trees often present a black discoloration of the bark, which is quite unsightly, and excites alarm for the health of the tree. This is often caused by trimming at unfavorable periods; in the spring pruning of bearing trees, the large stumps sometimes bleed, but in the nursery trees it arises from cutting them, and especially in the barbarous trimming up, during severely cold weather, when they are frozen.

NUTS. In a botanical sense, a nut is the fruit of a tree or shrub, consisting of a hard shell enclosing the germ and its envelopes, called the kernel. Thus the hickory, walnut, hazel, chestnut, beech, and oaks bear nuts. The seed of the peach, plum, cherry, almond, olive, etc., are termed stones or pits, (drupes,) and those of the apple, pear, orange, lemon, etc., are pips. Thus nuts are kernels contained directly in a more or less hard shell; drupes, are nuts enveloped in a pulpy pericarp, or fleshy covering without valves; pip fruits are those fleshy fruits containing the seeds either directly in the pulp, or else in scaly compartments in the middle of the fruit. In mechanics a nut is a small block of wood or metal containing a concave or female screw.

O

OAK. Trees of the genus *Quercus*, the most valuable of any genus of forest trees, remarkable for their close grain, durability, firmness, and toughness of timber; noted also for their majestic size, and handsome appearance. The white oak grows naturally in a rich, moist, loam, or rich sandy soil underlaid with clay, also on any moist, strong, clay soil. The bur oak (upland) grows on rich, rather dry soils called barren, and the swamp bur oak, on rich moist bottom lands. The barren scrub oak, and the black oak is found on the provost, sometimes on sands. The classification of American oaks, and including the European introduced species, by Michaux, are divided into two divisions as follows: White oak (*Quercus alba*), seventy to eighty feet high. Common European oak (*Quercus robur*), sixty to eighty feet high. European white oak (*Quercus robur pedunculata*), sixty to eighty feet high. Mossy-cup oak (*Quercus olivæformis*), seventy to eighty feet high. Over-cup white oak (*Quercus macrocarpa*), seventy to eighty feet high. Post oak (*Quercus obtusiloba*), thirty to fifty feet high. Over-cup oak (*Quercus lyrata*), sixty to seventy feet high. Swamp white oak (*Quercus bicolor*), sixty to seventy feet high. Chestnut white oak (*Quercus prinos*), seventy to eighty feet high. Rock chestnut oak (*Quercus Montana*), thirty to forty feet high, Yellow oak (*Quercus acuminata*), sixty to seventy feet high. Small chestnut oak (*Quercus chinquapin*), a shrub of three to four feet high. Live oak (*Quercus virens*), evergreen, forty to sixty feet high. Cork oak (*Quercus suber*), Spanish tree. Willow oak (*Quercus phellos*), thirty to sixty feet high. Laurel oak (*Quercus imbricaria*), shingle oak, forty to fifty feet high. Upland willow oak (*Quercus cinerea*), evergreen Southern, twenty feet high. Running oak (*Quercus pumila*), two feet high. Second Section.—Leaves lobed. Bartram oak (*Quercus heterophylla*), said to be found only on one plantation. Water oak (*Quercus aquatica*), thirty to forty feet high. Black Jack oak (*Quercus ferruginea*), small, barren oak. Bear oak (*Quercus banisteri* var. *ilicifolia*), two to nine feet high. Barren scrub oak (*Quercus Catesbæi*), fifteen to thirty feet high. Spanish oak (*Quercus falcata*), seventy to eighty feet high. Black oak (*Quercus tinctoria*), sixty to seventy feet high. Scarlet oak (*Quercus coccinea*), eighty feet high; produces brownish ink galls. Gray oak (*Quercus ambigua*), a hybrid, seventy to eighty feet high. Pin oak (*Quercus palustris*), forty to sixty feet high. Red oak (*Quercus rubra*), seventy to eighty feet high. To this list may be added the Southern oak, *Q. Michaux.* Others have also been added, but the list we have given compose the important species.

OAK APPLE. Spongy excrescences on the young branches of various oaks, and produced by insects of the genus *Cynips*, are called oak apples. When they become hard they are called oak galls, and are used in the manufacture of ink and for other purposes. They contain a large amount of tannin.

OAK INSECTS. The oaks are subject to the attacks of various insects, including the leaves, the young wood, the inner bark, and also boring into the solid wood. Of the latter the borers, especially the water borers, are particularly destructive to the timber. The oak twig pruner, *Stenocorus putator*, (*Elaphidion villosum*,) deposits an egg in the tender twig, which hatching the grub subsists upon the pith until fully grown. It then gnaws away the wood, and retiring backwards, waits until the branch falls to the ground, when it is in due time transformed into the perfect insect. Sometimes, branches several feet in length and an inch in diameter are thus severed. Their destruction is easy by collecting and burning the fallen branches. The same means will apply to all the twig pruners. The following is a list of insects the larva of which attack the wood and dead leaves of the oak, which with the succeeding will be of interest to many readers: *Chrysobothris femorata*, wood; *Chrysobothris calcarata*, white oak wood; *Chrysobothris dentipes*, wood; *Agrilus*, Europe, some, in wood; *Throscus*, Europe, some, in wood, wainscoting; *Eucnemidæ*, wood; *Fornax*, stumps; *Alaus ocu-*

latus, wood; *Alaus myops*, wood; *Ptilodactyla elaterina*, wood; *Prionocyphon discoideus*, hollow stumps, in water; *Dictyopterus sanguineus*, Europe, under bark; *Tillus ambulans*, wood; *Cistela ceramboides*, Europe, in oak; *Lagria hirta*, Europe, dead leaves; *Pyrochroa coccinea*, rotten wood; *Synchroa punctata*, rotten wood; *Lucanus dama*, wood; *Platycerus quercus*. wood; *Passalus cornutus*, wood; *Lymexylon navale*, Europe, ship timber and wood; *Lymexylon sericeum*, wood; *Hylocætus Americanus*, wood; *Ptilinus pectinicornis*, Europe, wood. Insects attacking the foliage are as follows: *Macrodactylus subspinosus*, foliage; *Lachnosterna fusca*, foliage; *Lachnosterna micans*, foliage; *Lachnosterna hirtacula*, foliage; *Holotrichia crenulata*, foliage; *Trichestes tristis*, foliage; *Polyphylla variolosa*, foliage; *Cotalpa lanigera*, foliage; *Osmoderma scabra*, foliage. The following insects attack the stumps or work under the bark: *Centronopus calcaratus*, stumps of black oak; *Xylopinus saperdoides*, stumps of black oak; *Helops micans*, under bark; *Pseudoclerus ichneumoneus*, under bark, probably destroying other insects. The oak also suffers from the attack of phylloxera, principally inhabiting the leaf galls, but found generally on the hickory; as the American oak phylloxera, *P. Rileyi*, which, says Dr. Riley, is found on the under side of the white and post oaks, in the wingless state. Of insects not given in the previous list attacking the oak, Dr. Thomas gives the following: *Tremex columba, Xylentes robiniæ, Pandeletrius hilaris, Lucanus elephus, Phyllophaga fracerna, P. pilosicollis, P. fusca.*

OAT. *Avena sativa.* The native country of the cultivated oats like most of our cultivated grains is uncertain. It was in earlier times, cultivated extensively as food for man, and of late years, since improved processes in hulling and preparing the grain have been invented, its use as a most healthy and nutritious food is yearly increasing. The best and heaviest oats are raised in cool and moist climates; Scotland and Friesland, having long been noted for the superior weight and quality of the crop. In the United States, Canada, Wisconsin, and the Red river country of the North are eminently adapted to the cultivation of the crop. Oats are said to have been cultivated in Massachusetts as early as 1602. As in England their great use is as food for horses, than which there is no other grain that alone can take the place, where fast work is demanded. Skinless oats, *Avena nana*, have from time to time been introduced under various names, but they shell so easily and suffer from so many contingencies that their cultivation is not profitable. Oats like a firm, strong, moderately dry clay or loam, though they may be successfully cultivated on lighter soils, if not too dry, than for most other cereals. Excelsior, White Shonen, Potato oats, New Brunswick, White and Black Swedish, Red, or rust proof oats, (for the South.) Hopetoun, Yellow, (remarkably early,) Wythe, King William, Goochland, Wilkes' Blount, Clark, Sandy, Board of Trade, (probably White Norway,) Tartarian, Poland, White Dutch, Surprise, and Probsteir, are all varieties that have succeeded well. These varieties are not really new as to the list, but new, or comparatively so, to the United States. Among the varieties that have done well generally, may be mentioned, Potato, Poland, Surprise, White Shonen, Tartarian, Somerset, and Probsteir. The average yield of oats for the United States may be stated at thirty to thirty-five bushels. Upon good land, well prepared, and in good seasons, the yield will average forty bushels, and in particular instances the crop will give eighty and even 100 bushels per acre. As an instance of what may be done by manuring on thin soil, at the Massachusetts Agricultural College, on a rocky, drift-soil, a plot without manure gave fifteen bushels per acre, with manure the yield was sixty-two bushels per acre. In relation to the value of sowing clean seed, an experiment at the Agricultural College of the University of Wisconsin, made by Prof. Daniels, reports that, repeating an experiment made in 1871, he sowed May 24, 1872, two adjacent plots, each of 112 square rods, with Surprise oats, fifty-four quarts to each plot. The seed on one plot had been well cleaned from chaff and light grain, and the seed on the other plot was sown as taken from the bin; weight of the cleaned seed, sixty-six and three-quarter pounds, and of the uncleaned, sixty-two and one-half. The following table summarizes the results for the two years:

Preparation of seed.	Weight of product per bushel, pounds.		Yield per acre, bushels.	
	1871.	1872.	1871.	1872.
Cleaned........	35.50	25.00	48.25	17.50
Uncleaned......	33.50	25.00	43.75	15.30

In the prairie region of the West oats should always be sown on fall plowing, and as early in the spring after wheat sowing, as the soil is dry and in good condition for working. Late sown oats are as a rule light from the heat and drought of the advancing season. Nevertheless oats should not sprout until all danger of extreme frost is over. Yet we have never had oats killed if sown at any time after the frost is out and the ground settled in spring.

OATS. (See article in Supplement.)

OBJECT GLASS. The glass, or lens, of the telescope nearest the object.

OBLATE. Somewhat spherical, but flattened in the perpendicular axis, as an orange, the world.

OBSIDIAN. A black, glassy, compact lava, consisting of potash and soda, seven to ten per cent.; silica 77.50; alumina 11.75; iron 1.25.

OBTUNDENTS. Mucilaginous, oily, or bland substances, which reduce the acrimony of other medicines.

OCCIPITAL BONE. The bone which forms the back portion of the skull, to which the spinal column is attached.

OCHRE. Peroxide of iron mixed with clay; the color is very durable.

OCHREA. The leaf-stems which clasp or surround the stem, as in the case of some grasses.

OCTAGON. A superficial figure, with eight sides or angles.

OCTAHEDRON. A solid, with eight regular sides; it is one of the most common figures of crystals, and may be a derivative from the cube or tetrahedron.

OCTANDRIA. The Linnæan class, in which the flowers contain eight stamens.

ODERITE. A species of black mica.

ODOMETER. A wheel, the axis of which turns a graduated scale, so that the distance over which it passes on a road is recorded in feet and miles. It may be attached to a carriage wheel, or to that of any vehicle.

ODONTOLOGY. A treatise on the teeth.

ODORIN. A very concentrated empyreumatic oil, obtained by rectifying oil of bones.

ŒDEMA. Puffiness of a part of the body, produced by a dropsical effusion or collection of watery fluid.

ŒNANTHIC ETHER. A volatile oily body, to which the peculiar vinous flavor of wine is owing; by boiling with potash it becomes converted into œnanthic acid and alcohol.

ŒSOPHAGUS. The gullet or swallow.

ŒSTRUS. The genus of Gad Flies. (See Bots.)

OFFSET. In building, the superior surface left uncovered by the continuation upward of a wall where the thickness diminishes, forming a ledge.

OFFSETS. In surveying, short distances from the chain-line, usually measured with a rod, called an offset-staff, the most convenient length for which is six feet 7.2 inches, being equal to ten links of the surveying chain. In gardening, young radical bulbs, when separated or taken off from the parent roots, are so called. One of the chief methods of propagating plants is by offsets.

OFFSPRING. (See Breeding, Generation, etc.)

OGEE. In molding, is a line resembling the italic *f*.

OGIVE. The pointed arch.

OIDIUM. (See Fungus.)

OIL. The oils consist principally of carbon and hydrogen, they, however, have a great affinity for oxygen, and if exposed to the air soon absorb oxygen and thus become rancid, since besides oleine they contain more or less of other matter. Hence, the reason why fats so soon become putrid, so oils when oxydized either become rancid or are converted into resins. The fluid fats, oils of vegetables and animals, agree very closely as to their structure, as the following table will show, the constituents being those of a well known vegetable and an animal oil:

	Carbon.	Hydrogen.	Oxygen.
Olive oil consists of.... ...	77.2	13.3	9.5
Spermaceti "	78.9	11.8	10.2

Oils are divided into expressed or fixed oils, which are also subdivided into drying oils and common oils, and into distilled or essential oils. The common fat oils are like almond and olive, bland, preserving their flavor for a time, but at length becoming rancid; palm oil is solid. The drying oils are like linseed, hemp seed, nut oil; they attract oxygen readily from the air, evolving heat, and become solid. The essential oils impart to flowers and aromatic bodies their odor; they are very volatile, and are obtained by distilling the leaves or flowers with water. All vegetables contain a proportion of oil of some of these varieties, which may be obtained by digesting them in ether and alcohol; it is, however, frequently below one per cent., while in other cases, as the nut, it is more than sixty per cent. In provender, the fattening quality is closely related to the percentage of common oil. The following table shows the per cent.:

Product.	Per cen
Common maize	8 to 12
Rice	0.8
Oats	5.5
Rye	1.8
Rye flour	3.5
Hard wheat	2.6
Wheat flour	2.1
Fine bran	4.8
Coarse bran	5.2
Dry clover	4.0
Dry lucerne	3.5
Meadow hay	3.8
Oat straw	1.1
Bean meal	2.1
Beans	2.0
Peas	2.0
Lentils	2.5
Potatoes	0.08
Mangel-wurzel	0.1
Carrots	0.17
Oil-cake	9.0 to 15

M. Payen found that the oil was everywhere present in the seeds of gramineous plants. The embryo contains much, the husk less, the farinaceous portion still less; but maize and oil-cake contain about nine per cent., whence the universally admitted superior fattening power of these two articles, so often practically proved. The plants principally cultivated for oil, are the olive, linseed, castor, bean, rape, bene-plant, pea-nut, sunflower, etc. Corn is also worked for its oil to some extent. The principal animal oils, are procured from the fat of swine, the whale, the cod, and other fish, also from seals and other marine animals. The residue, both fish and animals, after the oil is expressed, makes a most valuable manure, and the residue of many of the oil bearing seeds are valuable for fattening animals, as that of linseed, the pea-nut, while the residue of all are valuable as manure. When the cotton seed of the South comes generally to be used in this way, it will add greatly to the productiveness of the soil. Wax is a substance nearly allied to the oil producing fats. In fats, oils, and wax, from various countries, now in the Museum of the Department of Agriculture at Washington, we find the following, which include a number of essential oils: There are about half a dozen samples of vegetable tallow and wax in this series. One specimen of the last named, the product of *Myrica jalapensis*, is received from Mexico. The vegetable wax of China and Japan is produced from the fruit of several trees belonging to the genus *Rhus*. The most important of these is *Rhus succedanea*, and is grown extensively. *Rhus vernicifera*, the lacquer tree, also yields a wax, differing only in a slight degree from that of the wax-tree mentioned above. *Rhus sylvestris*, or the wild wax-tree is also worthy of mention. Vegetable tallow is produced in Japan from the *Cinnamomum pedunculatum*. Other specimens of vegetable tallow and wax are from the valley of the Amazon. The oils are quite numerous, and, where it has been possible to do so, the vegetable products from whence derived are shown with them. Linseed and the more common oils have been received from various countries. The Russian collections included oils of anise, mustard, hempseed, walnuts, sunflower, wild rape, camline seed and poppy, with a few specimens of the refuse or

OATS.—Rank and yield of the States, with average annual product for the past nine years.

Rank.	States.	Total value of Crop.	Value per Acre	No. of Acres.	Amount of Crop. Bush.	Yield per Acre. Bush.
1	New York	$15,200,860	$13.43	1,163,919	38,586.000	32.2
2	Pennsylvania	12,813,490	11.83	1,090,208	33,342,600	30.5
3	Illinois	12,740,356	7.61	1,683,238	49.558,899	30.2
4	Ohio	7,950,676	9.00	884 954	25,401,436	28.6
5	Wisconsin	7,197,292	10.57	694,388	24,623,025	34.8
6	Iowa	6,241,785	7.71	826,743	28,444,150	34.2
7	Missouri	4.454,015	7.36	608,559	16,875,265	27.8
8	Minnesota	4.184,172	10.40	406,728	13,865,250	34.2
9	Michigan	4 168,509	11.69	359,282	11,543,262	31.9
10	Indiana	4.076 673	7.35	552,353	13,955,478	25.5
11	Georgia	3,483 633	9.15	387,548	5,021,910	12.9
12	Kansas	2,692,220	6.61	409,368	13,156 000	32.7
13	Virginia	2,517,154	6.04	423,781	6,128,787	14.4
14	Kentucky	2,512,718	8.52	295,743	6,450,400	21.8
15	Tennessee	2,120,428	7.63	278,325	5,193,240	18.7
16	California	2,015,728	22.30	91,608	2,813,762	30.6
17	North Carolina	1,942.607	8.09	244,049	3,570,925	14.6
18	Vermont	1 854.504	16.13	115,468	4,111,960	35.6
19	New Jersey	1,720,702	11.93	145,779	4,098,475	27.9
20	Texas	1,555,184	19.41	89,023	2,746,500	30.1
21	Maryland	1.262,382	7.62	166,578	3,294,950	19.5
22	Oregon	1,248,547	16.40	76,159	2,637,875	34.7
23	Maine	1,082,542	13.19	85,135	2 202,625	26.0
24	Nebraska	1,031,204	6.21	164,585	5.372,375	32.7
25	Alabama	979,324	10.14	101,197	1,471 698	14.2
26	West Virginia	943 098	8.29	115,369	2,670,327	23.0
27	South Carolina	672,532	9.71	69,869	899,500	12.7
28	New Hampshire	610,502	18.80	32,963	1,206,095	36.7
29	Connecticut	595,586	16.47	37,509	1,082,860	29.3
30	Arkansas	574 475	12.78	47,680	1,099 318	23.0
31	Mississippi	556 353	12.32	46,154	702,870	15.2
32	Massachusetts	345,613	17.94	18,860	617 525	32.6
33	Delaware	154,293	8.41	18,316	395,450	21.9
34	Florida	123,882	12.63	9 807	133,306	14.0
35	Nevada	70,740	30.27	2,381	80,600	34.0
36	Rhode Island	67,690	16.58	3,957	120,400	30 1
37	Louisiana	27,455	14.20	1,795	27,083	15.0

oil cake. Oils of Japan are represented by rape-seed oil, which is used for illuminating purposes, together with fish oil in Japanese households. The South American collection is quite interesting, and includes gingelly oil, (*Sesamum indicum*), cocos oil, from the cocos-palm, secua oil, (from a cucurbitaceous plant), seje oil, from another species of palm, crab oil, from *Carapa guianensis*, ground-nut oil, castor oil, etc. Linseed, ricinus, and cotton-seed oils are shown from our own country, the last named in connection with its principal manufacture, that of soap, a full series of which is shown. A valuable collection of essential oils was purchased for exhibition at Philadelphia, and these have since been added to the museum collections. Among them may be mentioned oils of hemlock, wintergreen, wormwood, golden rod, peppermint, spearmint, sassafras, pennyroyal, bergamot, cedar, oil of neroli, etc., the last named from flowers of *Citrus aurantiacum*, oil of sweet birch, (bark of *Betula lenta*), and oil from roots and stems of several species of *Spiræa* are shown. Among the animal products in this subsection are many specimens of beeswax, both native and foreign. A few animal-fats are also shown from South America; candles and soaps are also included in this group, limited collections of which were received from various localities. The mineral products are represented by series of coal-oils and petroleum, principally from our own country. Specimens of raw and crude paraffine are also exhibited, with some of the products of petroleum, as benzine, naphtha, etc. In this connection may be briefly mentioned a number of specimens of water-proof goods, canvas, leather, wood, etc., rendered so by paraffine in solution. They are impervious to water while freely admitting air.

OIL-CAKE. The remains of seeds, especially linseed, after expression for oil. Linseed and several other oil-cakes are used for fattening. It is remarkably rich in oil, containing often fifteen per cent., and ranks high as nutriment. Rape, mustard, hemp, castor oil, and other cakes are admirable manures. The Flemish mix them with their fluid manure.

OIL, FUSIL. A volatile aromatic oil formed in the fermentation of potatoes or grains where hops are not employed, and which yield an alkaline mash; it comes over in the last portion of the distillation for the alcohol; when concentrated, it is oily and very nauseous.

OIL OF SPIKE. (See Lavender.)

OIL OF VITRIOL. Sulphuric acid.

OIL OF WINE. Two liquid oily bodies, as well as the œnanthic ether, are known by this name; the former arises from distilling ether off caustic lime, and are sulphates of the oxide of ethyl.

OKRA. *Hibiscus esculentus.* A plant producing handsome flowers, and mucilaginous pods, valuable for soups, stews, etc., much esteemed at the South, and also in the West, being both healthful and nutritious. It is a principal ingredient of Gumbo which may be called the national dish of the South and of France as well, where it is also highly prized and from whence the dish, known South as Gambo, originally came; the French residents of Louisiana and other Southern States using it largely in many of those delicious dishes, the making of which came from their ancestors. Being as tender as the tomato, the seeds should not be planted until after the middle of May, in the North, or not until corn is up and of a healthy color. It is better, like Lima beans, if sown in troughs by nailing strips of siding as a back against the edge of fencing, each sawed three feet long. Thus the back of one trough makes the front of another. When six inches high, or when the nights are permanently warm, transplant three feet by three, in very rich soil, having two or three plants in a place. Thus you may often have okra to cut by the first of August, or even the middle of July, and thence forward until frost comes. The pods should be taken when two or three inches long and while yet tender, since, if let they soon become stringy. The ripe seeds are sometimes used to mix with coffee, and really is one of the best adulterations known, if a healthy substitute may be called adulteration.

OLEACEÆ. The family of trees and shrubs containing the olive, ash, and privet.

OLEANDER. *Nerium oleander.* A beautiful evergreen, with large, rosaceous flowers. It requires shelter in the green-house, or in a dry light cellar in winter, and is propagated with ease by cuttings kept moist. The leaves, however, are poisonous if eaten by animals, and children should be warned against eating them. The Oleander is peculiarily subject to "Mealy bug" when kept during winter in living rooms with their dry atmosphere, and hence should be wintered in a cool, dry cellar.

OLECRANON. The bone of the elbow. A process of the ulna.

OLEFIANT GAS. An inflammable gas, condensing spontaneously into a fluid oil, with an aromatic odor. It consists of two atoms carbon and two hydrogen.

OLEIC ACID. The acid of oleine (*elain*), or the fluid portions of fats, separated by alkalies from the glycerine.

OLEOMARGARINE. A preparation of the fat of neat cattle, much used of late years for making fictitious butter, and for adulterating butter and cheese. When prepared in a cleanly manner, and from healthy fat, it is nearly identical in its composition with true butter, and fully equal in nutrition, but lacks, of course, the aroma which is sought to be supplied in some respects, in various ways. Strict laws have been passed in some of the States, against its sale except under its true name. Yet large quantities are palmed off on the unsuspecting, and many dishonest dealers and makers of butter and cheese employ its use. Recent analysis of several samples of butter from various sources and also of three samples of oleomargarine, by the chemist of the Department of Agriculture, will show the near identity of these different fats. The large quantity of sugar in the New York butter and in samples of oleomargarine, No. 7 and 8 are undoubtedly due to artificial means. The chemist, in his report adds: That the small quantity in the other samples may be due to the product of decomposition in the butter analyzed, which products deported themselves in a manner similar to sugar in their effects upon the reagents used in the analysis. The butters analyzed included the following, viz: One specimen each of Danish, Swiss, and French butter, one specimen each of Iowa butter of second quality, New York dairy butter, and oleo margarine bought in

Washington markets. Also two specimens of oleomargarine received from House Committee for District of Columbia.

No.	Name.	Fats.	Caseine.	Salt.	Sugar.	Water.	Total.
1	Danish	90.94	1.46	2.75	.52	4.17	99.84
2	Swiss	87.73	1.91	2.50	.65	6.35	99.14
3	French	87.36	.86	4.74	.18	6.80	99.94
4	Iowa...........	6.09	1.82	2.76	.13	9 05	99.85
5	New York	83.92	2.23	4.10	1.82	7.66	99.73
6	Oleomargarine	84.92	1.19	6.65	.60	5 89	99.25
7	Oleomargarine	84.72	.69	6.21	1.33	7.19	100.14
8	Oleomargarine	86.28	.59	5.05	1.26	6.85	100.03

In animal fats the fatty acids insoluble in water form from 93.5 to 96 per cent., while in true butter the insoluble fatty acids average from 85.5 to 87.5 per cent. of the butter fat, and never exceeds 89.6 per cent. Hence, since in the sample of oleomargarine No. 6 the fatty acids equal 95.96 per cent. of the fats, it will be seen that this sample of oleomargarine was made from animal fats to which had been added a little milk in the process or manufacture. In washing a true butter with water, the water becomes milky, and a portion of these washings under the microscope show a vast number of fat globules present in the buttermilk contained in the butter. The specimens of oleomargarine No. 7 and 8, on the contrary, give a nearly clear water by washing, and this water is almost entirely destitute of fat globules except that, since milk is used in their manufacture to a limited extent, there was found a comparatively small number of fat globules in the washings of these specimens of oleomargarine. In relation to the history and manufacture of oleomargarine, as practiced in New York, and given in the Transactions of the American Dairymen's Association, for 1878, we quote as follows: About the year 1870, we begin to read of the application for and the granting of patents for improvements in the processes of refining oils and fats; very modest in their pretensions at first, but growing bolder and more startling in their claims with their order of succession. The first process was patented by H. W. Bradley, January 3, 1871. His specifications claim that his invention relates to a new composition for lard, butter or shortening, whereby a very cheap lard or butter is manufactured, superior to ordinary shortening, and answering the purpose of lard, butter or cream for culinary and other purposes. The product manufactured was composed of beef or mutton tallow, refined vegetable oils, and lard or stearine. This is a very modest claim. The next process proposed was patented by one Perouse, November 2, 1871. His claim had the one object, to enable the application of fine fats (especially beef fat) to alimentary and culinary purposes, and make such fat take a position between lard and butter, give it a good appearance, smell and taste, and also give it digestible qualities far superior to the freshest butter or lard. The product made by this patent was a mixture of beef fat, carbonate of soda, chloride of alumina and sodium, and bore no resemblance to butter. The next process patented worth considering was by Paraf, in April, 1873. The specifications and claims in this patent approach nearer to the true process for the manufacture of artificial butter. The product manufactured under Paraf's patent was called oleomargarine because butter was at one time considered to be a compound chiefly composed of oleine and margarine, but later investigations show margarine to be a mixture of palmatine and stearine. Paraf, started a large company called the Oleomargarine Manufacturing Company, in New York city, having for its object the manufacture of the oleomargarine, so-called. The product manufactured by Paraf's patent resembles butter when seen at a distance, but, on examination with a microscope, was seen to have a distinct grain, which was very distinguishable on tasting; it possessed no odor or flavor of butter, and, after keeping a short time, lost its color, and acquired the odor of beef suet, from which it was made. The next process, and it is one similar to Paraf's, was first patented in England, by Mége, in 1869, and afterwards in this country, in 1873, and finally re-issued May 12, 1874. This re-issue contains all the valuable points in both the English and American patents, and is now the property of the United States Dairy Company. These patents cover two principal operations in the manufacturing of butter from the fat of animals, viz: First, the extraction of the oil at a low temperature; and second, the converting of the oil, by churning with milk, into butter. Prof. Mott was employed by the United States Dairy Company, to make a series of experiments for the perfecting of the artificial product at their factory in Brooklyn, during a period of several months. He became satisfied that good butter could only be made by the use of the oil rendered at a very low temperature—below 125° Fahr. Whenever made at a higher temperature the oil, or the butter made from it, would smell like tallow after standing a few days, which smell would be sufficient to repel any butter buyer from purchasing it. This smell is occasioned by using oil rendered at a temperature above 125°, being tainted by the decomposition of the animal membranes. In conducting his experiments his object was to make a product containing no element foreign to the very best of butter. His first discovery was a process by which he was enabled completely to remove the grain from the artificial product of butter. This process is described in his true process of making artificial butter. How to introduce into this product the true odor and flavor of butter, without injuring its texture, was a problem of considerable difficulty, but after working at it for three months, it was finally discovered. Another patent is yet to be considered—that of Garret Cosine, dated February 15, 1876, for improvement in processes for making artificial butter. The object of this patent is to make two products, one for winter and the other for summer use. The winter product consists of oleine and fruit, or nut oil, flavored with milk and salt. The summer product is similar to that made by Paraf, and not salable in market. This patent of Cosine's is the most startling yet out, for even the nutty flavor of Jersey butter is attempted. With respect to the temperature stated by Brande for the melting point of fat being 100° Fahr., Prof. Mott found that he must evidently refer to fat freed from its membrane, as the fat can not be practically separated from its membrane under a temperature of 109° Fahr., and then only in very exceptional cases. As in the manufacture of natural butter, when a good product is to be obtained, the first and most important principle to be observed is entire cleanliness. Mott's process for making oleomargarine is as follows: The fat, on arriving at the factory, is first weighed, and then thrown into large tanks containing tepid water, care being taken to place all pieces that are dirty or bloody in a separate tank to be washed. The fat in the tanks should be covered with tepid water and soaked for an hour, when the water is drawn off and the fat thoroughly washed in cold water; then covered again with fresh cold water and allowed to stand an hour longer; the water is then again removed, and the fat thoroughly washed for the last time with fresh cold water, when it is ready for the next operation, which is the disintegrating or chopping process, which is done by passing it through a meat hasher or chopper, where it is cut by means of revolving knives very fine, and forced through a fine sieve out of the machine into a tub. In the melting process, the fat is next removed to the melting tank, care being taken to drain off all the water remaining. It is heated by means of water surrounding the tank, until the temperature reaches 116°. when the steam which heats the water is turned off. The water surrounding the tank being much warmer than the melted fat, increases its temperature to about 122° to 124°, when the fat is completely melted. During the whole operation of melting, the fat must be constantly stirred to maintain an even temperature. The adipose membrane, called scrap, settles to the bottom, and a clear yellow oil floats on top. The melting process, when conducted rightly, takes two or three hours. The oil should then stand at least twenty-four or thirty-six hours to granulate, and the temperature of the room should be 80°. This is a very important operation, and must not be hurried, otherwise the stearine in the oil will not have time to crystallize. For the pressing process, the refined fat is removed to the press room, which should be of a temperature between 80° and 90°. It must not be so solid that it can not be easily worked with the fingers. It is next packed in cloths set in moulds, to form packages four inches wide, eight inches long, and one and one-half inches thick. These packages are then placed upon galvanized iron plates in the press at equal distances apart, and piled one above another until the press is filled. They are first subjected to a slight pressure, which is increased gradually until the oil begins to flow slowly. The oil is received in tin vessels, and the pressing is continued until no more oil can be obtained. The pressure is then removed, the plates unpacked, when cakes of pure white stearine, about eight by five inches long, and one-fourth of an inch thick appear. The stearine is now ready for sale, while the oil obtained from the press is removed to a cool place until it reaches a temperature of 70°, when it is ready for the next operation. The percentage of butyrine, caprine, caproine, etc., (essential oils of butter,) contained is so very small, (being derived from the milk in the last churning process,) that it is not sufficient to make the butter become rancid when decomposed; but quite sufficient, says Prof. Mott, to give to the butter the so much prized flavor and odor The analysis of Prof. Mott of the two compounds shows that natural butter contains 7.6 per cent. of those flavoring oils, while the artificial butter contains only .26 per cent. of them; and this small portion, which is obtained from the milk in the process of churning, has not much effect upon the taste; and can not be expected to have. The oil at the proper temperature of 70°, is taken to the churning room; 100 pounds of oil are put into the churn at a time, with from fifteen to twenty pounds of sour milk. About two and a half or three ounces of a solution of annatto, to which has been added from one-half to three-fourths of an ounce of the bicarbonate of soda, must now be added, and the whole churned twelve or fifteen minutes, until milk, coloring matter and oil are thoroughly mixed together, when the whole mixture is withdrawn from the churn, through a hole in one end, and allowed to fall into a tub containing pounded ice. As the oil flows on the ice it must be kept in constant motion until the tub is filled with solidified oil. Crystallization is by this simple process completely prevented. The solidified oil, which now has an orange color, is left two or three hours in contact with the ice in the tub, when it is dumped upon an inclined table, where it is crumbled so that the ice may melt and leave the oil, which is crumbled by hand fine, and about thirty pounds at a time again introduced into the churn, with twenty or twenty-five pounds of churned sour milk, and churned for fifteen minutes, when the solidified oil takes up a certain percentage of the milk, as also the flavor and odor, which were washed out by the ice after the first churning, and pure butter (?) is produced. This is now removed to the working table, where after draining it is salted to the extent of three-quarters to one ounce of salt to the pound of butter. After proper working it is packed in firkins and is ready for sale. The following tables give the percentage of fat, oil and butter realized in the manufacture of oleomargarine. Percentages by the melting process in 100 parts:

Refined fat	78.63	per cent.
Soap grease	4.31	" "
Scrap membrane	17.06	" "
Total	100	

By the pressing process, in 100 parts of refined fat:

Oil	76.31	per cent.
Stearine	23.69	" "
Total	100	

Per cent. of oil from 100 parts of caul fat:

Oil	60.00	per cent.
Stearine	18.63	" "
Scrap and soap grease	21.37	" "
Total	100	

By the churning process, in 100 parts oleomargarine butter:

Oil	83.00	per cent.
Salt, milk, etc	5.00	" "
Water	12 00	" "
Total	100	

Cost of manufacture per pound of butter:

This will equal the expenses per day, minus the amount realized by the sale of other products; thus if the expenses per day are.	$96.25
And the receipts from other products sold are	15.66
Will leave the cost of the manufacture of the butter at	$80.59

This for 500 pounds, is equal to 16.1 cents per pound. This calculation is based upon paying ten cents a pound for the fat, and selling the butter made at twenty-five cents per pound. Prof. Arnold gives the composition of butter as follows: The fatty matter which enters into the composition of the butter globule consists of four varieties. The hardest of them is stearine, which, when separated, is a hard, white, flaky appearing fat. The second in consistency is palmatine, which resembles palm oil; most of the coloring matter in butter is connected with this fat. The third is called oleine, from its thin, oily consistency. The fourth consists of essential oils of the food of the cow, and which probably are as numerous as the varieties of food she consumes. These constitute the fats of which butter is made. Their origin is not perfectly clear; they are all ultimately derived from the food of the cow, but how much of them are elaborated in the body of the animal out of other elements of food is not well established. Their characteristics change with the condition and quality of the food, and with the constitutional peculiarities of cows. The fats from different cows living on the same food are often quite unlike, and in the same cow they change their qualities, such as color, density, odor and flavor, with the variations in food, as to its age, succulence and abundance or scarcity of fat in it. Young food generally gives a higher flavor and color to these fats than that which is mature or approaching maturity. The percentage of these essential oils which enter into the composition of butter is very slight, amounting, on an average, to about two per cent. They are very variable in butter, by reason of feed and faulty making. The following is an analysis of the fats of butter by Prof. Mott, giving the constituents in natural and artificial butter:

Constituents.	Fats from Natural Butter.	Fats from Artificial Butter
Palmatine..........................	20.33	22.32
Stearine............................	42.77	46.94
Oleine	27.71	30.42
Butyrine. Caproine. Caprine Capryline } Essential or Vegetable Oils.......	9.19	.32
Total..........................	100.00	100.00

OLERACEOUS. Of the nature of culinary vegetables or pot herbs.

OLFACTORY NERVES. The first pair proceeding from the brain, and distributed in the nose. They constitute the sense of smell, and in some animals are most highly developed.

OLIBANUM. A fragrant Eastern gum resin. Frankincense.

OLIVE. The Olive has been successfully cultivated for many years on the coast of South Carolina, Georgia, Florida and Alabama; so far, however, more in an amateur way than with a view of reaping profit from pressing the oil. The olive, *Olea Europæa*, has always held rank as the most important oil-producing plant, until of late years, scientific horticulture and improved processes for expressing oils from various substances has rendered it less and less necessary for culinary use, and has furnished far cheaper substitutes for burning. Its history is given as follows: Homer mentions green olives in the garden of Alcinous and Laërtes, which were brought by Cecrops, the founder of Athens, to Greece. Minerva is related to have planted it with her own hand upon the consecrated locality of her citadel, by thrusting her spear into the ground. No temple or sacred place dedicated to her was without its olive tree. The olive belongs to the fruits which were promised to the Jews in Canaan. This tree was first brought to Italy in the year 571 before Christ, and at the time of Pliny had been carried over the Alps to Gaul and Spain. At the time of Cato, the Romans were acquainted with only nine kinds of olives, which, however, at the time of Pliny, had increased by cultivation to twelve. The cultivated olive tree, was distinguished from the wild olive by the ancients. Willkom is of opinion that the olive tree is indigenous in various parts of the Mediterranean region, Spain, and also in the southern portions of the Peninsula. He states that the olive forest of forty square miles at the foot of the Sierra Morena, to the south, between Andujar and Cordova, may have been entirely planted by hand. He is also of opinion that the olive forest, three leagues in length, situated further south, between Seville and Utrera, to the left of the Guadalquivir, consists of olive trees run wild, having small globular fruit possessing but little oil. He thinks that this forest could only have sprung up in consequence of the driving away of the Moors, or from the neglect of former olive plantations, as has been the case in other instances. He thinks himself, however, safe in stating that the hedges and forests of olives in the southern part of Spain may have arisen from indigenous plants. The wild olive tree forms forests and groves, not only in the plains of Seville, where it has certainly arisen from the running wild of originally cultivated olive trees, but in the mountains also, as in the Serrania da Ronda, etc. It is most frequently met with in wild sandstone mountains, rising to a height of 4,000 feet along the Straits of Gibraltar, between Algesiras and Alcalá de los Gázules, where, from 2,000 feet and upwards, it forms a principal constituent of the indescribably magnificent foliage which covers that mountain. Some early attempts were made to introduce the olive into the United States, and it would undoubtedly flourish on dry or rocky soils from southern Tennessee south. On page 685 is an illustration showing an olive branch and fruit, with blossom at the right. Mr. Jefferson, writing from Paris in 1787, remarked that, although the olive was a tree the least known in America, it was the most worthy of being known. Of all the gifts of heaven to man, said he, it is next to the most precious, if it be not the most precious. Perhaps it may claim a preference even to bread, because there is such an infinitude of vegetables which it renders a proper and comfortable nourishment. In passing the Alps at the Col de Tende, where they are mere masses of rocks, wherever there happens to be a little soil there are a number of olive trees and a village supported by them. Take away these trees, and the same ground in corn would not support a single family. A pound of oil, which can be bought for three or four pence sterling, is equivalent to many pounds of flesh by the quantity of vegetables it will prepare and render fit and comfortable food. Without this tree the country of

Provence and territory of Genoa would not support one-half, perhaps not one-third, their present inhabitants. The nature of the soil is of little consequence, if it be dry. The trees are planted from fifteen to twenty feet apart, and, when tolerably good, will yield fifteen or twenty pounds of oil yearly, one with another. There are trees which yield much more. They begin to yield good crops at twenty years old, and last till killed by cold, which happens at some time or other, even in their best positions in France. But they put out again from their roots. In Italy (I am told) they have trees two hundred years old. They afford an easy but constant employment through the year, and require so little nourishment, that if the soil be fit for any other production, it may be cultivated among the olive trees without injuring them. Wherever the orange will stand at all, experience shows that the olive will stand well, being a hardier tree. The olive is a low, branchy, evergreen tree, rising from twenty feet to thirty feet, with stiff, narrow, bluish-green leaves. The flowers are produced, in small axillary bunches, from wood of the former year, and appear in June, July, and August. Near Terni, in the vale of the cascade of Marmora, is a plantation above two miles in extent, supposed to be the same plants mentioned by Pliny as growing there in the first century. With protection from severe frost, Miller says, it may be maintained against a wall in the latitude of London. In Devonshire some trees have stood the climate for many years. It is to be hoped that the cultivation of the olive may be extended in the South. It would add one more means of revenue, and upon soils unfit for other crops. It is hardly probable that the pressing of the oil would be profitable, but the pickled fruit would be much superior to that imported. The following is the process of pickling in France: For each pound of the fruit, take a pound of good strong ashes, (those from the hickory wood are the best,) and an ounce of good slaked lime; mix the lime and ashes with water, until a soft paste or mortar is formed, into which stir or imbed the olives, and finish by covering the whole mass with a layer of dry ashes. Let them remain in this state until all the bitumen is extracted, which may be known by the stones slipping readily out of the pulp, when squeezed between the fore finger and thumb, for which purpose a few may be tried once an hour, or oftener, if desired. The length of time required for this, however, will depend entirely upon the quality of the ashes and lime, and may vary from two or three hours to as many days. As soon as the olives have been deprived of their bitterness, they must be cleanly washed, and put to soak in fresh water, which must be changed about once an hour, for twenty-four hours, when the taste of potash will have been removed, and the water cease to be discolored. The olives must then be put into bottles or jars, and a strong brine put over them, made from good alum, or other pure salt. This brine will generally require to be changed several times, in consequence of becoming ash-colored, after which, the bottles must be sealed air-tight; and, if kept in a cool, dry, dark place, the olives will keep good for years. Olives carefully cured after this plan, will be found less salt than those pickled in France, which are usually sold in this country, and will retain much of the nutty flavor of pure olive oil. We append a list from a late Spanish work on olives, of varieties, their uses, and adaptation to climates.

OLIVE BRANCH AND FRUIT.

SPANISH VARIETIES EARLY MATURING FOR COLDER LOCALITIES.

Var. *Promiformis.*—Manzanillo; (French, *Ampoulleau.*)—Fruit above an inch in diameter, spherical, shining black.

Var. *Regalis.*—Sevillano: (French, *Pruneau de Catignac.*)—Fruit about an inch in diameter, ovate-spherical, blunt, bluish-black.

Var. *Bellotudo* or *Villotuda.*—Fruit about an inch long, egg-shaped: pericarp outside dark red, inside violet.

Var. *Redondillo.*—Fruit ovate-spherical, nearly an inch long; pericarp outside bluish-black, inside whitish. A rich yielder.

Var. *Ovalis.*—Lechin; Picholin; Acqnillo; (French, *Saurine.*)—Fruit broad-oval, two-thirds of an inch long. A copious yielder.

Var. *Argentata.*—Nevadillo blanco; Doncel; Gorzalena; Moradillo; Ojiblanco; Olivo lucio. Fruit broad-ovate, an inch long very blunt, not oblique. Quality and quantity of oil excellent.

Var. *Varal blanco.*—(French, *Blanquette.*)—Fruit ovate, globular, three-fourths of an inch long, neither pointed nor oblique, outside blackish-red.

Var. *Empeltre.*—Fruit ovate, an inch long, equable. Rich in oil of excellent quality, also one of the best for pickles. Outside violet, inside white.

Var. *Racimal.*—(French, *Bouteillan*, *Boutiniene*, *Ribien*, *Rapugette.*)—Fruit violet-colored, globose-ovate, about an inch long, neither pointed nor oblique. Bears regularly also on less fertile soil, and is one of the earliest to ripen.

Var. *Varal negro;* Alameno; (French, *Cayon, Nasies.*)—Fruit violet-black, spotted, globose-ovate, nearly an inch long, somewhat pointed. Bears richly.

Var. *Colchonudo.*—Fruit spheric, outside red, inside white, one inch in diameter, slightly pointed. Produces a large quantity of good oil.

Var. *Ogillo de Liebre.*—Fruit nearly spheric, outside violet-black, about one inch long, somewhat oblique

Var. *Currasquena.*—(French, *Redouan de Cotignal.*)—Fruit black-red, almost spherical, slightly oblique, about an inch long Valuable both for oil and preserves.

Var. *Hispalensis.*—Gordal; Ocal; Olivo real..—Fruit black-gray, oblique, spherical, measuring fully an inch. Rather a large and quick growing tree. Fruit used in the green state for preserves, not used for table-oil.

Var. *Verdejo.*—Verdial, (French, *Verdal; Verdan.*)—Fruit black-violet, oblique spheric, pointed, about one inch long. Furnishes good oil, and resists best of all the cold.

SPANISH VARIETIES OF LATE MATURING FOR WARMER LOCALITIES.

Var. *Maxima.*—Madrileno, Olivo morcal.—Fruit over an inch long, cordate-globose, strongly pointed. Valuable for preserves.

Var. *Rostrata.*—Strong and tall plant, very hardy. Fruit black-reddish, over an inch long, oval, much pointed. Good for oil.

Var. *Ceratocarpa.* (French *Odorant; Luquoise.*)—Fruit fully an inch long, oval, pointed.

Var. *Javaluno.*—Fruit black-gray, over an inch long, egg-shaped, somewhat oblique, gradually pointed. Rich in good oil.

Var. *Picudo.*—Fetudilla.—Fruit fully an inch long, egg-shaped, blunt at the base, pointed at the apex, with black-gray pulp. Good both for oil and preserves.

Var. *Nevadillo negro.*—Fruit egg-shaped, fully an inch long, with turned pointed apex. One of the richest of all varieties in yield, and ripens moderately early.

FRENCH VARIETIES MERGING INTO THE SPANISH KINDS.

Var. *Angulosa.*—Laurine.—For preserves.

Var. *Rouget.*—Marvailletto.—Produces a fine oil.

Var. *Atrorubens.*—Salierue, Saverne—Fruit dusted white. Furnishes one of the best of oils.

Var. *Variegata.*—Marbee. Pigale. Pigau.—Purple fruit, with white spots.

Var. *Le Palma.*—Oil very sweet, sparingly produced.

Var. *Atrovirens.*—Pointue. Punchuda.—Fruit large, with good oil.

Var. *Rubicans.*—Rougette.—Seed small, yield annual and large.

Var. *Alba.*—Olive blanche. Blancane. Tierge.—Productive, but inferior.

Var. *Caillet Rogue.*—Figanier.—Tree small. Fruit large, red. Oil good and produced in quantity.

Var. *Caillet Blanche.*—Fruit almost white, produced annually and copiously, yielding a superior oil.

Var. *Raymet.* Fruit large, reddish. Oil copious and fine. This variety prefers a flat country.

Var. *Corignac.*—Fruit middle-sized, blunt. Oil obtained in considerable quantity, and of excellent quality.

Var. *Bermillaon.*—Vermillion.—Yields good table-oil. Tree very hardy.

OLIVILE. An amylaceous body obtained from the gum of the olive tree.

OLIVINE. A green, volcanic mineral. A silicate of magnesia and iron.

OMBROMETER. A rain gauge.

OMENTUM. The membrane or caul that lies over the intestines, and becomes loaded with fat.

OMNIVORES, OMNIVOROUS. Eating animal and vegetable food.

OMPHALODIUM. The point in the hilum or scar of a seed through which the nutritious vessels pass.

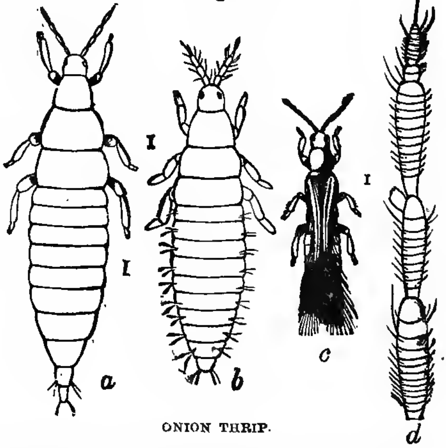
ONION. *Allium cepa.* The onion is one of the oldest cultivated as it is one of the most celebrated of ancient vegetables. In Egypt, it attained great excellence and mildness, probably from the steady heat, and constant moisture of irrigation in connection with the rich alluvial soil of the Nile. The Israelites in their wanderings in the desert, lamented the loss of onions as one of their privations. Of the Egyptians and their worship of the allium tribe, Juvenal wrote:

> Now Egypt, mad with superstition grown,
> Makes gods of monsters, but too well is known,
> 'Tis mortal sin an onion to devour,
> Each clove of garlic has a sacred power.
> Religious nation, sure! and blest abodes,
> Where ev'ry garden is o'errun with gods!

The onion is cultivated extensively in every civilized country, and forms a considerable article of transport from one place to another. Besides the general cultivation, vast quantities are grown along the Mississippi river in Iowa, for transportation South. In the Eastern States, especially in Connecticut, large quantities are grown for export. There are a great many varieties, but the Danvers Yellow and Large Red are principally cultivated for their keeping qualities, and the Silver Skin for pickling. The Yellow Strasburgh is also a valuable variety in general cultivation, but the two first named are preferred for shipping. The crop requires a rich, deep, mellow soil, heavily manured. It is better that they be sown as early in the spring as the ground can be worked on fall plowing. Three to four pounds of fresh seed is the usual quantity sown per acre, in drills eighteen inches apart, and half an inch deep. The cultivation is entirely by hand machines and superficial, working close to the crop. When the plants are three inches high, thin to two inches apart. Keep free from weeds, and as the bulbs begin to form, draw the earth away rather than to the bulbs. Never cultivate deeply, as it will injure the surface roots. As the crop gains size the tops gradually die down, and early sowings generally ripen in the West, in August. When the tops are entirely dry, the onions are collected into thin windrows, with spaces between to dry for a few days. When dry, the tops are pulled off, the bulbs cleaned of the rough skins, when they are ready for market. If the onions are to be stored for winter, they should be kept in a cool airy place, in thin layers, until late in the autumn, they are then carried to a cold dry cellar, and stored on racks, in layers six or eight inches deep. They may also be saved in heaps, out of doors, by piling in a dry place, just before hard frosts set in, covering carefully with hay, and then with earth, just so they will freeze slightly. Thus they should not be touched until the frost draws out of them naturally, when they must be immediately sold.

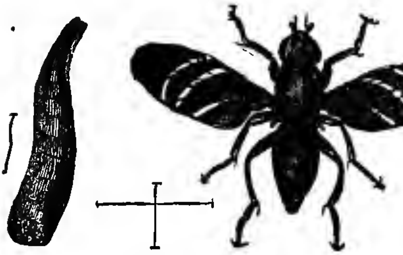
ONION, INSECTS INFESTING. Within the last ten years the onion crop of the United States has been seriously infested with insects, especially with the maggot, the larva of a European fly, and also a native species, which seem to have multiplied rapidly from some unknown cause. A minute Thrip, *Limothrips tritica* has also made its appearance. The cut,

Fig. 1.



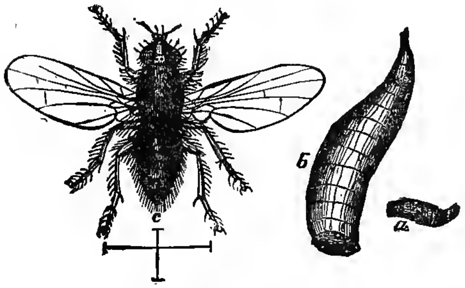
ONION THRIP.

Fig. 2.



NATIVE ONION FLY.

Fig. 3.



IMPORTED ONION FLY.

Fig. 1, shows the insect in its several stages, magnified, the hair lines showing the natural size. The figures *a*, *b*, show larvæ; *a*, male; *b*, female, and the figure at the right shows the antenna very highly magnified, as will be readily understood, when we recollect that the adult is less than an eighth of an inch in diameter; *c*, perfect insect. Of the onion fly, there are two species, the Native Onion Fly and maggot, (*Ortalis flexa*) shown at Fig. 2, enlarged, the hair line natural size. Fig. 3 shows the European Onion Worm, (*Anthomyia ceparum*), imported into the United States over forty years ago; *a*, natural size; *b*, maggot, and *c*, the fly magnified, the hair lines giving the natural size. The report on the Rocky Mountain Locust, and other injurious insects, for 1877, describes both species. The following is partly taken from the reports of Dr. Fitch, New York. Speaking of the imported fly, we find that in June, as soon as the young seedling-onions are only an inch or two in height, these insects commence their depredations and continue them through the whole season, getting their growth and coming out in their perfect state one after another, whereby some of the flies are liable to be always present in the garden, in readiness to deposit their eggs; and maggots of widely different sizes are commonly met with in the same onion. The eggs or fly-blows are loosely placed upon the onion slightly above the surface of the ground, some being dropped along the thin edge of the sheath or white membraneous collar, which is formed by the base of the lower leaf clasping around the stalk, and others are crowded into the crevices between the bases of the leaves, slightly above where they issue from this sheath. From two to six or more eggs are usually placed on particular plants here and there through the bed. They are perceptible to the eye, being white and smooth, four-hundredths of an inch (0.04) long, and a fourth as thick and of an oval form. When the minute maggot hatches from the egg, it works its way downward inside of the sheath, its track being marked by a slender discolored streak, till it reaches the root, on which it feeds till it is wholly consumed, only the thin outer skin remaining. After eating the bulb of one plant they attack the next, until sometimes a third or a half of the bed is destroyed. The maggot attains its growth, in summer, in about a fortnight, and changes to a pupa either in the cavity in the onion, or in the wet, slimy earth which is in contact with the onion. It here ceases to move, it becomes contracted and shorter in length, its skin hardens and changes to a tarnished yellow and finally to a chestnut color with a stain of black at each end This is the pupa-case, and the true pupa is inside. In this condition it lies about two weeks before the fly escapes. As a preventive measure worth trial the seed should be sown two inches deeper than usual, so that the fly can not so readily get to it to lay its eggs. Sow also on ground on which straw has been previously burned Rotation of crops is also a most important preventive measure. When the roots are infested pour boiling water along the drills near the roots, or even on the plants, going over the bed four times during one season. The diseased onions should be pulled up and burned. Fitch recommends cultivating the onions in hills, scattered among the other vegetables in the garden. With only three or four seedlings in a hill it is evident that the young worms could nowhere find a sufficient amount of food to nourish them to maturity. Having consumed all the young plants in one hill, they will be unable to work their way through the ground to come at another hill except it be by the merest chance, and will thus perish. The Black Onion Fly was first found to be destructive to onions in Illinois by Dr. Henry Shimer, who writes as follows regarding it. In the latter part of June I first observed the larva or maggot among the onions here; the top dead, tuber rotten, and the maggots in the decayed substance. From them I bred the fly. They passed about two weeks in the pupa state. At that time I first observed the flies in the garden, and now few are to be found. Their favorite roosting place is in a row of asparagus running along the onion-ground, where they are easily captured and destroyed, from daylight to sunrise, while it is cool and wet. During the day they are scattered over the ground and on the leaves and stalks of the onions, and not easily captured. Their wings point obliquely backward, outward, and upward, with an irregular jerking, fan-like movement; flight not very rapid or prolonged. All that I observed originated in one part of the bed, where they were doubtless deposited by one parent fly. Two broods appear in a season.

OOLITE. Roe stone. A limestone of the secondary epoch, the parts of which are rounded so as to resemble a fish roe. Oolitic is a derivative.

OPAL. An iridescent, silicious mineral, of a rich brown color, tough consistency, and smooth, uniform texture; its peculiar narcotic smell should be strong and fresh; its taste bitter, warm and somewhat acrid.

OPERCULUM. A lid or covering. The

coverings of the theca of mosses. In zoology this term is applied to the apparatus supported by four bones, which protects the gills of fishes; also to the horny or calcareous plate which closes the aperture of univalve shells; and to the four calcareous pieces which defend the entrance to the tube of Balanites, or bell-barnacles.

OPHIDIANS, OPHIDIA. The order of reptiles resembling snakes.

OPHTHALMIA. (See Eyes, Inflammation of.)

OPIUM. (See Poppy.)

OPOBALSAM. Balm of Gilead. A fragrant gum resin, from a species of Amyris.

OPODELDOC. A liniment of soap and camphor.

OPOPONAX. A gum resin of a bad odor from the *Pastinaca opoponax.*

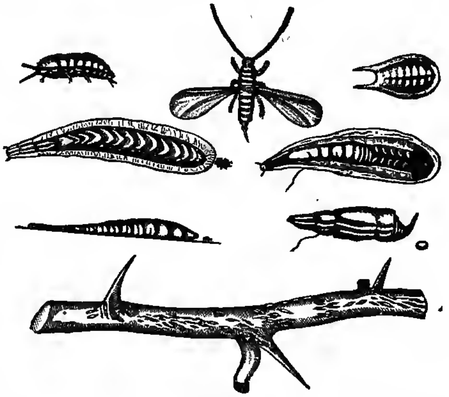
OPOSSUM. The genus *Didelphys* of marsupials, peculiar to the American continent.

OPTIC NERVES. The second pair from the brain. They enter the back of the eyes and form the retina.

OPTICS. The science which investigates the property of light, and all that relates to vision.

ORACH. *Atriplex hortensis.* A hardy annual plant, the leaves of which have a slightly acid taste, which in some portions of Europe are, with the footstalks, boiled as we do spinach. It should be sown early in spring, in deep, rich, moist soil, in drills two feet apart, and kept free from weeds until the leaves are of size for boiling. It is but little cultivated in the United States.

ORANGE. *Citrus aurantium.* The orange, originally a native of the warmer portions of Asia, is now generally disseminated and grown in all countries where the winter frosts are not severe enough to kill the trees. In the United States, South Carolina and Georgia, the Gulf States and Southern California comprise the northern limits of cultivation. It is especially cultivated with a view to profit, in Portugal, Spain, France, Italy, Greece, Turkey, Syria, Egypt, northern and southern Africa, India, China, Japan, and on many of the islands adjacent to these countries; also in the Azores, the West Indies, Brazil, and the warmest portions of the United States. The first distinct notice of the orange on record is that made by Avicenna, an Arabian physician, who flourished in the tenth century. It is stated by Gelesio, a modern Italian author, that the Arabs introduced this fruit into Europe by two routes—the sweet oranges through Persia to Syria, and thence to the shores of Italy and the south of France, and the bitter ones by Arabia, Egypt, and the north of Africa to Portugal and Spain. It was the opinion of this writer, who described forty of the principal kinds, cultivated in Italy, that they were all derived from the same species—an opinion which appears to be corroborated by the circumstance that the whole citrus family is prone to change, from a difference of soil and climate, as well as from a tendency to sport, when cultivated from seeds, after the manner of most of our orchard fruits. In many parts of the West Indies and South America, for instance, the whole orange tribe is found growing wild, springing up spontaneously from the seeds of the trees originally planted by the Spaniards, varying in size and every gradation from the lime to the shaddock. In Florida, it has long been cultivated. Bartram mentions a famous orange grove in Florida, which was found in 1781, when the surveyor ran the lines near New Smyrna, north for forty miles along a ridge; and further stated that extensive groves were found as far north as latitude 28°. Dr. Baldwin, in 1817, mentions trees thirty feet high, and says: You may eat oranges from morning till night, at every plantation along the shores, while the wild trees, bending with their golden fruit over the water, present an enchanting appearance. These were the remains of the trees, or the wildings, from those planted by the early Spanish settlers. The cultivation of the orange is steadily extending in Florida and California. In other Southern States its cultivation is not extending, although there is no doubt that it might be profitably extended along the coast line of southern Texas. In the planting of orange groves in Florida, water protection is sought to the northwest. If this can not be had, ridges are selected, since these are less liable to spring frosts than lower situations. The North is now cheaply and amply supplied with oranges from Florida, and in California the cultivation of this noble fruit is steadily increasing Besides blight, and fungus, there are a number of insects attacking the orange. The blight is often very destructive. There are no certain remedies for this disease. The trees die back somewhat, as is the case with pears. It has been recommended to cut below all diseased parts and re-bud. Drainage and careful cultivation would seem to be the most rational course to pursue. One of the most noxious of the insects attacking the orange is the Orange-tree Mussel Shell Louse, (*Aspidiotus Gloverii*). The illustrations show the insect in its various stages of transformation up to the perfect fly. The natural remedies are, as in the case of the Apple-tree Bark Louse, scraping them off, and at the time in summer when the young are active, washing the branches with strong soap suds.



ORANGE, WILD. *Prunus Caroliniana.* A kind of cherry evergreen, and growing to the size of a small tree; the fruit is not edible, but the tree is much esteemed on the Southern seaboard as an ornamental plant. It is a native of Florida.

ORBIT. In birds, the skin which surrounds the eye; the bony cavity in which the eye is set.

ORCHARDING. One of the first necessities in settling a new country, is to prepare for and set out an orchard. Few, however, either do so systematically, or when they do set one, care for it as it should be. Hence the idea of some that fruit will not do well in many portions of the country, even in localities where there are great commercial orchards yielding bountifully. The reason of the failures in making the farm orchard productive is, first, accurate knowledge as to varieties adapted to the soil and climate. This can only be learned by experience, close observation, or inquiry from some responsible and practical man. Fortunately there are such in almost every neighborhood. Another source of failure is the planting of too many varieties. Once the farmer finds the varieties adapted to his location, let him select the best of these, and then if he wishes to experiment with special varieties, do it with individual trees, or else by grafting a limb with the variety desired. Very often a variety that is a shy bearer will bear abundantly for years if grafted on another variety. The experiment will cost but little time and labor. The laying out of the orchard is also important. In commercial orchards particular varieties should be placed in blocks, and also those varieties which ripen in succession in the order of ripening. The commercial orchardist, however, understands this, and also the profit in planting but few varieties. With the farm orchard the same general rule should be adopted, but as this is simply to supply the family's daily use, the earlier varieties of fruit should be placed next the house, and the general supply for winter use farther away. Suppose the fruit garden (that is the proper name) to comprise two acres, and this is not too much, then the first rows may be strawberries, planted three feet apart as to the rows; then currants and gooseberries, four feet between rows; next raspberries, five feet between rows; next blackberries, six feet between rows; grapes, eight feet between rows; quinces, eight feet; peaches, twelve feet between rows; cherries, sixteen feet between rows; plums, nectarines, and apricots, the same distance, if you choose to try them. Next come pears, ten feet should be allowed for dwarfs, and twenty feet for standards; apples, twelve feet for dwarfs, and thirty feet for standards. A single row of strawberries, of raspberries, and of blackberries, of currants, and of gooseberries across a two acre plot will be ample for any family for using fresh, and for canning. A single row of peaches, one row of cherries, and one-third of a row each of plums, nectarines, and apricots, will be sufficient. We do not advise their planting at all, since the labor of destroying the curculio will, probably, amount to more than the worth of the fruit; nevertheless this must be left to the discretion of the planter. One row of dwarf pears, and one row of standards, will be enough. In prolific years you may have some pears to sell. If blight do not attack the trees, they will well pay the investment, in the satisfaction of having the fruit. The rest of the orchard may be planted to apples, perhaps one row of dwarfs, the balance standards, or the row of dwarf apples may be placed next the dwarf pears. We had forgotten the grapes. Allow two rows for these, one full row for Concords, and another row for such varieties as you may wish to experiment with. When plants are wanted by the acre, to find the required number multiply the distance at which they are to be set by itself, or the distance one way by the distance the other, and divide into 43,560, the number of feet in an acre. For instance three multiplied by four gives twelve. This divided into 43,500 gives 3,625. The number of plants contained in an acre. So, we may find the number of plants required for any distance not given in the table. The following table will show the number of trees in an acre at various distances:

GATHERING APPLES.

Distances apart.	No. of Plants.	Distances apart.	No. of Plants.
1 by 1	43,560	7 by 7	888
1½ “ 1½	19,360	8 “ 8	680
2 “ 1	21,780	9 “ 9	537
2 “ 2	10,890	10 “ 10	435
2½ “ 2½	6,969	11 “ 11	360
3 “ 1	14,520	12 “ 12	302
3 “ 2	7,260	13 “ 13	257
3 “ 3	4,840	14 “ 14	222
3½ “ 3½	3,555	15 “ 15	193
4 “ 1	10,890	16 “ 16	170
4 “ 2	5,445	17 “ 17	150
4 “ 3	3,630	18 “ 18	134
4 “ 4	2,722	19 “ 19	120
4½ “ 4½	2,151	20 “ 20	108
5 “ 1	8,712	24 “ 24	75
5 “ 2	4,356	25 “ 25	69
5 “ 3	2,904	27 “ 27	59
5 “ 4	2,178	30 “ 30	48
5 “ 5	1,742	40 “ 40	27
5½ “ 5½	1,417	50 “ 50	17
6 “ 6	1,210	60 “ 60	12
6½ “ 6½	1,031	66 “ 66	10

Strawberries may be set as close as twelve inches in the row; two feet, however, is better, if they

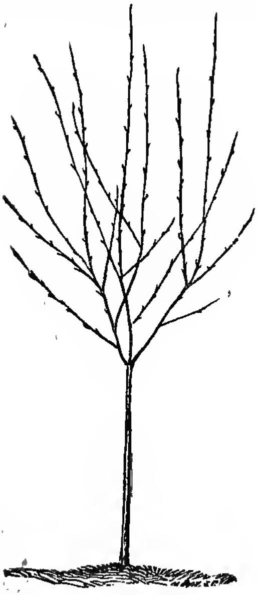


Fig. 1.

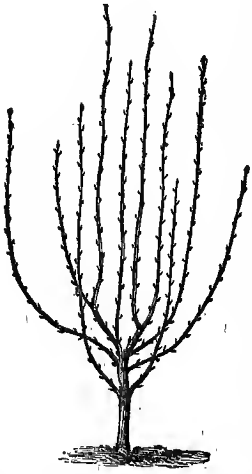


Fig. 2.

are to be allowed to make runners. Raspberries may be planted three to three and one-half feet, and blackberries three and one-half to four feet in the row. Currants and gooseberries, should have three and one-half to four feet of space in the row. Grapes may be planted as close as six feet in the row. The other fruits may be planted in the rows at half the distance the rows are apart, the supernumerary trees to be removed before they begin to crowd each other. In this plan for a home orchard the small fruits, including grapes, will occupy one-ninth of the plot. If you allow a single row to be filled with plums, nectarines and apricots, thus, these with the peaches, cherries and pears, (dwarfs and standards,) will occupy nearly one-quarter of the field, or accurately, five-eighteenths, leaving you about one and a quarter acres for apples. The orchard rows at the same time being long enough to afford every facility for horse cultivation. For small families, and for village gardens this must be modified, yet the same general plan may be adopted. It should hardly be necessary to say that the home orchard must receive good cultivation, that is, it must be kept free of weeds. The cultivation, however, should not be deep, simply deep enough to keep the surface friable, but without disturbing the roots. If weeds appear after the first of July they must be pulled by hand, or taken up with the hoe among the vines and bushes. Among the trees they may be mown if necessary, since late cultivation is injurious to fruit trees, vines and bushes. If an orchard is to be laid out for a given variety of fruit, the system of squares will be found most practicable. The quincunx form has been widely recommended. Practically it has little advantage, except in situations where it becomes necessary to take advantage of every inch of ground. Hence, the true quincunx, where each plant is exactly equidistant from its next neighbor, is scarcely ever practiced. To lay out an orchard in true quincunx form each tree, must be surrounded by six other trees at equal distances. This will give the greatest possible number of trees upon the ground. Lay out the ground by furrows according to the width of the rows apart, and then run furrows one way, half way between the lines. Thus you will get the correct space for the trees. Now set stakes at every space along the two outside lines and a row of pegs to indicate the first diagonal furrow, plow this and so continue with each additional one until the whole orchard plot is marked. To lay out an orchard square, all that is necessary is to furrow it out both ways, according to the distance of the trees apart. Where the furrows cross will be the points at which the trees are to be set. Now plow two furrows apart both ways, and if the orchard has been deeply plowed over the whole ground previously, a very little sighting each way will enable you to get the true position of each tree. It should be unnecessary to say that this plowing and marking out should be done in the fall previous to planting, and if the field has been in some crop requiring very deep cultivation and manuring for a year or two previous, it will be found to be so much the better. In the case of the home orchard, when a variety of fruit is to be raised, of course the rows will run but one way, and the subsequent cultivation must be only one way. The remarks on laying out an orchard apply solely to those intended for only one kind of fruit, and particularly to the stone and pip fruits When the ground is level or nearly so it is not difficult to get the trees exactly in line. If the ground is uneven or hilly, it will be found very difficult in practice. That they be in exact line, however, matters but little, since it is quite evident they will not keep in line, from inequalities in growth, but if trained to pretty low heads—absolutely necessary in the West—the tops will soon cover any imperfections. In the home fruit garden, however, the trees, bushes and vines should stand in exact lines one way, and be kept so by staking. In the general orchard, the trees should be staked until they get firm root, and thereafter if a tree inclines to get too much out of line, it may be brought back by judicious staking. The best site for an orchard is undoubtedly one facing north or north

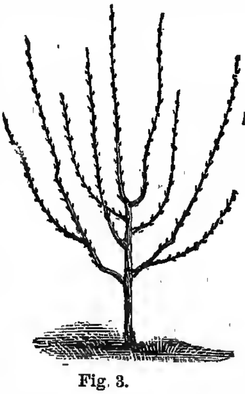


Fig. 3.

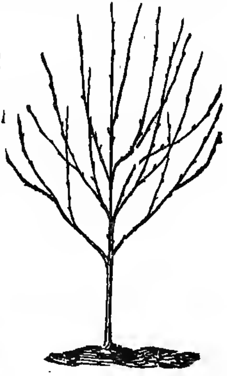


Fig. 4.

east, rather than south or southwest. The best soil is a deep, rich, gravelly clay loam, or limestone soil. If the subsoil is porous, no drainage will be needed. If the water ever stands for forty-eight hours at a time in holes dug eighteen inches deep, or if there is a hard pan within three feet it should be drained. The roots of the apple and pear like to run deep. The pear especially need not be expected to do well unless the subsoil is dry and porous enough to admit of the percolation of water. Such a soil will stand both drought and wet. In all the prairie country it has been found advisable to set orchards pretty near the surface of the soil, and plow to the trees year by year, and both ways until a considerable ridge is raised, or rather until a pretty deep dead furrow is formed between each row, leaving the trees at last on elevated squares. Many persons have been deterred from this course from the supposition that the trees would suffer from drought. Gardeners, however, well know that a flat well raised, deeply plowed ridge will stand drought far better than land under level culture. Some of our best gardeners on prairie soil now lay up their land to correspond to the width of the rows to be planted, five feet for tomatoes, six feet for cucumbers, and so on up to twelve feet for melons and squashes. For directions respecting the various orchard fruits, the reader is referred to the articles as they occur relating thereto. The following in relation to orchard trees when received from the nursery, or when propagated on the farm will be useful, and to assist this we give illustrations of various forms of pruning for training in the nursery. Fig. 1 shows a standard tree with stem of trunk three or four feet clear of branches. Fig. 2, Low branched standard, with stems eighteen inches to two feet. Apples on Doucin stock, have usually this form. Fig. 3, Dwarf bush, with stems a foot or more high. The dwarf apple on Paradise stock has usually this form. Fig. 4 shows the usual appearance of a well developed nursery tree, well trained and grown. For fruit trees the soil should be dry, either naturally or made so by thorough drainage, as they will not live or thrive on a soil constantly saturated with stagnant moisture. It should also be well prepared by twice plowing, at least, beforehand, using the subsoil plow after the common one, at the second plowing. On new, fresh lands, manuring will be unnecessary; but on lands exhausted by cropping, fertilizers must be applied, either by turning in heavy crops of clover, or well decomposed manure or compost, To ensure a good growth of fruit trees, land should be in as good condition as for a crop of wheat, corn, or potatoes. In regard to the preparation of the trees. As a general thing, trees are placed in the ground precisely as they are sent from the nursery. In removing a tree, no matter how carefully it may be done, a portion of the roots are broken and destroyed, and consequently the balance that existed in the structure of the tree is deranged. This must be restored by a proper pruning, adapted to the size, form and condition of a tree, as follows: Standard orchard trees. These, as sent from the nursery, vary from five to seven feet in height, with naked stems or trunks, and a number of branches at the top forming a head. These branches should be all cut back to within three or four buds of their base. This lessens the demand upon the roots, and enables the remaining buds to push with vigor. In case of older trees of extra size, the pruning must be in proportion; as a general thing, it will be safe to shorten all the previous years' shoots to three or four buds at their base, and where the branches are very numerous some may be cut out entirely. Pyramidal trees, if of two or three years' growth, with a number of side branches, will require to be pruned with a two-fold object in view, viz: The growth of the tree, and the desired form. The branches must be cut into the form of a pyramid by shortening the lower ones, say one-half, those above them shorter, and the upper ones around the leading shoot to within two or three buds of their base. The leader itself must be shortened back one-half or more. When trees have been dried or injured much by exposure, the pruning must be closer than if in good order. Low-headed standard trees and dwarf bushes must be pruned as recommended for standards, aiming at producing a round, well-proportioned head, with the main branches regularly distributed and far enough apart to admit air freely to all parts. Yearling trees intended for pyramids may have a few side branches, the smallest of which should be cut clean away, reserving only the strongest and the best placed. In other respects they will be pruned as directed for trees of two years' growth. Those having no side branches should be cut back so far as to insure the production of a tier of branches within twelve inches of the ground. A strong yearling, four to six feet, may be cut back about half, and the weaker ones more than that. It is better to cut too low than not low enough, for if the first tier of branches be not low enough, the pyramidal form can not afterward be perfected. Planting. Dig holes in the first place, large enough to admit the roots of the tree to spread out in their natural position; then, having the tree pruned as above directed, let one person hold it in an upright position, and the other shovel in the earth, carefully putting the finest and the best from the surface in among the roots, filling every interstice, and bring every root in contact with the soil. When the earth is nearly filled in, a pail of water may be thrown on to settle and wash in the earth around the roots; then fill in the remainder, and tread gently with the foot. The use of water is seldom necessary, except in dry weather, early in fall or late in spring. Guard against planting too deep; the trees, after the ground settles, should stand in this respect as they did in the nursery. Trees on dwarf stocks should stand so that all the stock be under the ground, and no more. In very dry, gravelly ground, the holes should be dug twice the usual size and depth, and filled in with good loamy soil. If trees are tall and much exposed to winds, a stake should be planted with the tree, to which it should be tied in such a manner as to avoid chafing. A piece of matting or cloth may be put between the tree and the stake. When the tree is planted, throw around it as far as the roots extend, and a foot beyond, five or six inches deep of rough manure or litter. This is particularly necessary in dry ground, and is highly advantageous everywhere, both in spring and fall planting. It prevents the ground from baking or cracking, and maintains an equal temperature about the roots. The grass should not be allowed to grow around young trees after being planted, as it stunts their growth and utterly ruins them. The ground should be kept clean and loose around them, until, at least, they are of bearing size. The best treatment for trees that have been frozen in the packages, or received during frosty weather, is to place the packages, unopened, in a cellar or some such place, cool, but free from frost, until perfectly thawed, when they can be unpacked, and either planted or placed in a trench, until convenient to plant. Treated thus, they will not be injured by the freezing. Trees procured in the fall for spring planting, should be laid in trenches in a slanting positions, to avoid the winds; the situation should also be sheltered and the soil dry. A mulching on the roots and a few evergreen boughs over the tops will afford good protection.

ORCHIDACEÆ. Herbaceous endogens with remarkably irregular and beautiful flowers; they are propagated by seeds, and bear bulbs containing an agreeable farina (*salep*) for which the *Orchis mascula* is partially noted. They are natives of calcareous soils. In the tropics the species and genera often become splendid parasites.

ORCHIL, or ARCHIL. *Rocella tinctoria.* A lichen yielding a purple dye.

ORCINE. The coloring matter of the *Violaria orcina*, or *Lichen dealbatus.*

ORDER. A style of architecture, or column.

OREGON ALDER. *Alnus Oregona.* An alder of from twenty-five to thirty feet.

ORES. Minerals containing a large amount of some metal.

ORGAN. In anatomy, a viscus, or structure of the body.

ORGANIC DISEASE. Disease attended with an alteration of the structure of a viscus or organ.

ORGANIC REMAINS. Fossils.

ORGANIZATION. The processes by which an organized body is formed; also the totality of the parts which constitute, and of the laws which regulate an organized body.

ORGANOGRAPHY. A description of the structure of plants.

ORIOLE. *Icterus.* There are two species, the garden oriole, *I. spurius*, and the Baltimore oriole, *I. Baltimore.* The first named is of a bright chestnut color, the head, neck, back, wings and tail black, bill and legs bluish-black. Mature birds, or after the third year, mottled on the upper parts of back with black and olive; on belly, sides, and breast reddish-gray begins to appear, blended with yellow; generally the two middle tail feathers are black, the others centered with black. The female and young of one year are olive yellow, inclining to brown, yellow beneath; wings and tail, dusky brown. The orchard oriole eats berries and small fruits to some extent during their season, but they are so largely insectivorous that they should be harbored rather than destroyed. It also eats largely of seeds. In confinement individuals often retain their summer plumage during the winter. They are alert and industrious in the pursuit of insects. The eggs are from four to six in number, bluish-white, sprinkled with brown. The nest is curiously interwoven of grass, and is supported by the sides only. The Baltimore oriole, also called golden robin or hanging bird, is one of the most beautiful of our summer visitors. Brilliant in its color, black and orange, cheerful in its song, an indefatigable hunter after insects, flitting here and there it should be carefully preserved wherever found. It is much rarer in the North than its relative the orchard oriole, and hence more highly prized. It has the name of hangbird from the peculiar pendant nest which it forms, in the South of the long hanging moss, and in the North of cotton threads or any long, soft filament which it may find. It loves the habitation of man, and is generally found near dwellings, and from the fact that it is seldom disturbed, often becomes tame and fearless of man. Another, Bullock's oriole, is found on the Pacific coast ranging from California to the Columbia river in Oregon; it is quite similar in appearance and habits to the Baltimore oriole.

ORLO. The plinth to the base of a column or pedestal.

ORNITHICHNITES. Certain marks in the new red sandstone, supposed, incorrectly, to be bird tracks.

ORNITHOLOGY. The department of science which treats of birds, their characteristics, their form, structure, habits and uses is called ornithology; from two Greek words signifying, a bird, and discourse. To the farmer, the study is of great importance as enabling him to distinguish between birds useful, those whose benefit is not counterbalanced by the injury they accomplish, and those decidedly injurious. Thus the horticulturist would narrow down his list of beneficial birds to a far greater extent than the grain farmer. The florist would find very few birds doing him injury, and the grass farmer or grazier almost none, if any. Agricultural ornithology may therefore very properly be considered outside of ornithology proper, since the rural population are especially interested in birds useful and injurious. These will be treated of under their proper names—which see—at least those of more special importance. In this connection we present a list of the more common birds of the country ranging from the lakes to Kentucky as the north and south lines. Further south our summer birds are, many of them, there, winter birds. The list was most carefully prepared by E. Michener, M.D., Pennsylvania, for the Department of Agriculture at Washington, and we believe has never appeared in print outside the Government report. It is the most condensed and complete catalogue of these classes we have found. A system of classification has been adopted with the names of the families, genera, and species. Immediately after will be found the common or familiar names. It is convenient to designate the species as, Constant residents; some portion, at least, of which remain nearly or throughout the year. Summer residents; greater or less numbers of which spend the summer, nest and breed. Winter residents; mostly northern species, which spend the whole or part of the winter. Migratory; those birds which pass and repass in spring and autumn. Wandering; birds which migrate irregularly, wherever their food may be most abundant. The reader will no doubt find many seeming exceptions to these divisions; for instance, the turkey vulture mostly migrates further south in winter, yet it has been seen in midwinter, when the mercury was below zero, striving with a crow for the possession of a dead mouse. Birds are also either Carnivorous: flesh-eaters—vultures, hawks, etc.

Piscivorous: fish-eaters—kingfishers, herons, etc. Insectivorous: insect-eaters—woodpeckers, fly-catchers, etc. Granivorous: grain-eaters—pigeons, sparrows, etc. Omnivorous: all-eaters—crows, blackbirds, etc. These terms are even more exceptional than the preceding ones. In a variable climate, or where the species migrates from warm summer to cold winter regions, or the contrary, its food must often vary with the season, etc. Hence, both as regards residence and food, the terms are only the expression of a general fact, and have, of course, only a relative application. Of land birds we have:

I. FAMILY VULTURIDÆ, (THE VULTURES).

Genus *Cathartes*, turkey vulture. Resident, common in summer; rare in winter; carnivorous; with us its chief food is carrion; feeds on all sorts of food, and sucks the eggs, and devours the young of other birds. The turkey buzzard, rendered so repulsive by its habits, is nevertheless a most useful scavenger for the speedy removal of every form of putrescent animal matter, so offensive to our olfactories, so prejudicial to our health. It well deserves the protection with us that both it and its cousin the black vulture receive in southern climates where they are almost domesticated.

II. FAMILY FALCONIDÆ, (THE HAWK.)

Among hawks, genus *Falco*, we have: Duck Hawk. Winter resident, very rare; carnivorous; feeds on ducks, pigeons, blackbirds, etc.—Pigeon hawk. Wandering, very rare; carnivorous; feeds on pigeons and smaller birds, field mice, etc.—Sparrow hawk. Resident, common; less so in winter; carnivorous. As its name implies, it feeds on sparrows and other small birds, field mice, shrews, and small reptiles.

Genus *Astur*. Goshawk. Winter resident, not common; carnivorous; preys on partridges, birds, field mice, etc.

Genus *Accipiter*. Cooper's hawk. Winter resident; rare; carnivorous. Its principal food consists of birds and small quadrupeds; when hungry, will not refuse a chicken for its dessert.—Sharp-shinned hawk. Resident, or nearly so; never abundant; carnivorous; feeds on small birds, mice, etc. The smaller members of this family mostly resort to the woods, fields, and meadows in quest of food, and seldom visit the poultry yard, unless pressed by hunger. The farmer can well afford them this small pittance for their service in destroying mice, shrews, moles, etc., in his fields.

Genus *Buteo*. Red-tailed hawk. Resident, common; carnivorous. The predatory habits of this powerful bird have rendered him the terror of the poultry yard. Partridges, larks, and other birds, rabbits, squirrels, mice, and even reptiles, form his less dainty fare. I must leave the farmer to balance the account as he best can.—Red-shouldered hawk. Winter resident, frequent in season; carnivorous; habits somewhat similar to the preceding species with which it is often confounded; but is much less troublesome to the farmer.—Broad-winged hawk. Resident, and quite rare; carnivorous; feeds on birds, mice, reptiles; rarely on chickens.

Genus *Archibuteo*. Rough-legged hawk. Winter resident. It is not common; carnivorous; affects meadows and the marshy borders of streams, where it feeds on such birds, mice, and reptiles as are found in those places. The number of meadow mice which this species destroys, ought, one would think, to insure it the protection of every husbandman.—Black hawk. Winter resident, rare; carnivorous; habits similar to those of the last-named species Audubon considers this the same as the rough-legged hawk in more mature plumage

Genus *Circus*. Marsh hawk. Wandering, mostly seen in winter; carnivorous; affects meadows and marshy grounds, hence its name; feeds on small birds, but more especially on mice and other small quadrupeds, and when in season, on frogs, snakes, etc.

Genus *Aquila*. Golden eagle. Wandering, but very seldom seen; carnivorous. With courage equal to his strength, he fearlessly pounces on a swan or a goose, a kid or a lamb, and, when instigated by extreme hunger, has been known to seize on little children and bear them off to his mountain aerie. Young fawns, raccoons, hares, wild turkeys, and other large birds constitute a portion of his bill of fare.

Genus *Haliætus*. White-headed eagle. Wandering, not common: piscivorous The principal food of the bald eagle is fish, and this is mostly plundered from the fish-hawk; sometimes preys on ducks and other water birds; when these fail, he will even feed on carrion, and, like his older brother, attack lambs, fawns, pigs, etc. Instances are related of his seizing small children and carrying them away to his nest.

Genus *Pandion*. Fishhawk. Wandering, frequent along the larger streams; piscivorous; affects our rivers and bays, and passes from one to another as the occurrence of ice, etc , may require. Feeds almost wholly on fish, which it catches with wonderful dexterity; too often, as has been noticed, to be robbed of its prize by the white-headed eagle.

III. FAMILY STRIGIDÆ, (THE OWLS).

Genus *Strix*, *Owls*. Barn owl. Winter resident, rare; carnivorous. "I am satisfied that our bird feeds entirely on the smaller species of quadrupeds " (Aud.) This, of course, refers to mice and other nocturnal animals.

Genus *Bubo*. Great horned owl Resident, frequent: carnivorous. "Its food consists of half grown turkeys, pheasants, and domestic poultry of every kind; also hares, young opossums, and squirrels." (Aud.) This is our most noteworthy robber of the hen-roost.

Genus *Scops*. Red owl. Resident, common; Carnivorous; preys on mice, small sparrows, etc., and very often catches nocturnal beetles and other insects. It thus destroys a large number of field mice, and the large cockchafer, so injurious to our fruit trees. In winter it familiarly enters our barns and outhouses, where it becomes an expert and industrious mouser. Mottled owl. Resident, common; carnivorous; habits similar to the last. Most ornithologists consider the red and gray screech-owls identical. This may be so. Bonaparte, Audubon, and others say the red is the young and the mottled the mature bird; others just reverse it. Audubon says the feathers change their colors as the pairing season advances, and in the first spring the bird is in its perfect dress; consequently the young or red bird could not be expected to breed, yet I have found red parents with a red brood, and also mottled parents with a mottled brood. Although presenting an anomaly perhaps unknown in any other species of bird, I have therefore reseparated them for the present.

Genus *Otus*. Long-eared owl. Resident, rare, or seldom seen; carnivorous. It preys chiefly on quadrupeds of the genus *Arvicola*, (meadow mice,) and in summer destroys many beetles.

Genus *Brachyotus*. Short-eared owl. Resident, frequent in winter, rare in summer; carnivorous; habits and food similar to those of the preceding species, which it somewhat resembles, except that it is more diurnal, and consequently feeds more on day food. When hungry, it will approach the farm-house in quest of garbage ejected from the kitchen.

Genus *Syrnium*. Barred owl. Resident, frequent; most so in winter; carnivorous A great destroyer of poultry, particularly of chickens when half grown; it also secures mice, rabbits, and small birds, and like other gourmands, is especially fond of a kind of frog common in the woods of Louisiana.

Genus *Nyctale*. Little owl. Resident, not common, or rarely seen; carnivorous; feeds on mice, beetles, moths, and grasshoppers, (Nutt.,) small quadrupeds and birds.—Snowy owl, *Nyctea*. Winter resident, very rare; carnivorous; rather diurnal or crepuscular than nocturnal. Its usual food while it remains with us consists of hares, squirrels, rats and fishes. It also catches the pheasant and other kindred birds.

IV. FAMILY CUCULIDÆ, (THE CUCKOOS).

Of the genus *Coccygus*, or cuckoos, we have the yellow-billed cuckoo Summer resident, common; insectivorous They seem to prefer insect food, but suck the eggs of other birds, and also feed on berries, etc. It should, however, serve as a special plea on their behalf, that they not only devour but even feed their young on the hairy caterpillars of our orchards, which are rejected by most other insectivorous birds.—Black-billed cuckoo. Summer resident, frequent; insectivorous. This and the preceding species very closely resemble each other, both in appearance and habits.

V. FAMILY PICIDÆ, (THE WOODPECKER).

Genus *Picus*. Hairy woodpecker. Resident, common; insectivorous; feeds on the larvæ of insects and on the insects themselves; although in autumn it seeks berries, etc. Downy woodpecker. Resident, common: insectivorous; habits and food similar. Red-cockaded woodpecker. Accidental; very rare; insectivorous; habits similar. These are highly useful birds in destroying worms and insects which lodge under dead bark and in rotten wood. Some of these birds have a singular habit, the purpose of which is not well understood, of puncturing the smooth, thin bark of orchard trees in regular circles, so near to each other that eight or ten of them may be covered by a dollar. This has obtained for them the common name of sap-suckers. They even puncture resinous trees in the same manner.

Genus *Sphyropicus*. Yellow-bellied woodpecker. Resident, rarely seen during summer; insectivorous; secluded in the forest. Its food consists of wood-worms and beetles, to which it adds small grapes and berries.

Genus *Hylotomus*. Pileated woodpecker. Resident, but now almost extinct; insectivorous. This shy bird feeds, like its congeners, on the beetles, and their larvæ, which always abound among dead and decaying timber. If these fail, he resorts to acorns, nuts, and berries.

Genus *Centurus*. Red-bellied woodpecker. Resident, frequent; rare in summer; insectivorous; feeds on various kinds of insects and larvæ, and on berries, etc., in the manner of its yellow-bellied cousin.

Genus *Melanerpes*. Red-headed woodpecker. Resident, very common; insectivorous. This elegant and familiar species is extremely expert in finding and catching the insects which conceal themselves beneath the bark of trees. He also eats juicy fruits and berries, as well as the ripening corn. The farmer often thinks that he takes more in cherries and garden fruits than his services are worth.

Genus *Colaptes*. Golden-winged woodpecker. Resident, common; rare in winter; insectivorous; feeds on insects, wood-lice, ants, etc., with cherries, various berries, and even corn. The farmer, forgetting his past services, and only remembering his present faults, closes his career with the gun, and unthinkingly does to himself and the public an essential injury. (Nutt.)

VI. FAMILY TROCHILIDÆ, (THE HUMMING BIRDS).

Genus *Trochilus*, is represented by the Ruby-throated humming bird. Summer resident, common; insectivorous. This beautiful little bird has so long been considered *mellivorous* (honey-eater) that the reader will hardly admit its claim to be insectivorous; but it is essentially an insect hunter, and not a honey-sucker. Its long, delicate bill enters the cup of the flower, and the protruded, double-tubed tongue, delicately sensible, and imbedded with a glutinous saliva, touches each insect in succession, and draws it from its lurking place to be instantly swallowed. Their food consists principally of insects, generally of the coleopterous order, with some equally diminutive flies.

VII. FAMILY CYPSELIDÆ, (THE SWIFTS).

Genus *Chætura*. We have Chimney swift. Summer resident, abundant; insectivorous. If the reader will reflect on the myriads of insects which fill the air on the approach of eventide, and watch these birds, as they wing their rapid flight in ceaseless circles, gathering their evening repast, he will not grudgingly endure the little annoyance which they may occasion in his chimney. The chimney swallows incline to be gregarious, especially in their roosting places. Audubon tells of a hollow tree in which he estimated that over nine thousand had collected, and were in the habit of collecting nightly to roost.

VIII. FAMILY CAPRIMULGIDÆ, (THE GOAT-SUCKERS).

Genus *anthrostomus*. Whip-poor-will. Summer resident, common; insectivorous; habits nocturnal; feeds on moths and other night-flying insects.

Genus *Chordeiles*. Night hawk. Summer resident, very common; insectivorous; habits much like the preceding, but more crepuscular or diurnal; often seen out in cloudy weather. Its food consists entirely of insects, especially coleoptera; it also seizes on moths and caterpillars, and is very expert at catching crickets and grasshoppers, with which it sometimes gorges itself.

IX. FAMILY ALCEDINIDÆ, (THE KINGFISHERS).

Genus *Ceryle*. Belted kingfisher. Resident, frequent along streams; piscivorous; feeds on fish and a few water insects.

X. FAMILY COLOPLERIDÆ, (THE FLY-CATCHERS).

Genus *Tyrannus*. Kingbird fly-catcher. Summer resident, common; insectivorous. Beetles, grasshoppers, crickets, and winged insects of all descriptions form his principal summer food; in autumn berries constitute a favorite repast. Reader, see him perched on an old mullen stalk, watching all around, and capturing every insect that comes in his sight, and say whether he does not pay for the few bees he may destroy.

Genus *Myiarchus*. Great-crested fly catcher. Summer resident, frequent; insectivorous; dwells mostly in forests and feeds on such insects as are found there

Genus *Sayornis*. Pewee fly-catcher. Summer resident, common; insectivorous. This familiar and industrious destroyer of insects needs no introduction, and is capable of telling its own story.

Genus *Contopus*. Olive-sided fly-catcher. Summer resident, not frequent; insectivorous; feeds on others of the genus.—Wood pewee fly-catcher. Summer resident, common; insectivorous. These two species are very similar and among the most active and industrious fly-catchers.

Genus *Empidonax*. Trail's fly-catcher. Summer resident, frequent; insectivorous.—Least fly-catcher. Summer resident, frequent; insectivorous.—Small green-crested fly-catcher. Summer resident, common; insectivorous.—Yellow-bellied fly-catcher. Summer resident, frequent; insectivorous. All the species of this genus, indeed all the family, possess similar habits. We can hardly walk out on a summer day without seeing some of them perched on a fence stake or dead bough intently watching for their prey, and woe betide the insect, whether beetle, moth, or fly, which may dare to show itself either on the ground or wing. The feat accomplished, they return to the same perch to await the appearance of other prey. Surely no observer can be so obtuse as not to appreciate the service thus rendered.

XI. FAMILY TURDINÆ, (THE THRUSHES).

Genus *Turdus*. Wood thrush. Summer resident, common; omnivorous. Beetles, caterpillars, various insects; and, in autumn, berries, constitute its principal food.—Hermit thrush. Summer resident, frequent; omnivorous; feeds on various insects, and small berries. Wilson's thrush. Summer resident, frequent; omnivorous. Like the preceding, its food is principally coleopterous insects and autumnal berries.—Olive-backed thrush. Summer resident, frequent; omnivorous; food and habits similar.—Gray-cheeked thrush. Summer resident, very rare; doubtful; omnivorous; unknown, except from analogy.—Robin. Resident, frequent; rare in winter; omnivorous. In early summer they feed much on the ground, picking up the various worms and insects of the season. In autumn they often resort to small fruits and berries. When winter arrives many of them East retire to the tide marshes of rivers, where seed and insect food are still found. When these have been long covered with snow the robins are said to return to orchards and find subsistence in the rotten apples still hanging on the trees.

Genus *Sialia*. Bluebird. Resident, very common; rare in winter; insectivorous. This favorite of every household, the lovely and confiding bluebird, seeks its food on the ground among grass. It seems to prefer coleopterous beetles, but also devours other insects, caterpillars, spiders, etc., and sometimes ripe berries. It well repays the use of the box, so often provided for its habitation.

Genus *Regulus*. Ruby-crowned wren. Migratory, frequent in season; insectivorous.—Golden-crested wren. Migratory, frequent in season; insectivorous. These species, very nearly identified by appearance and habits, are wholly insect feeders. Ever vigilant, they may be seen closely scanning the bark and leaves of trees and shrubs, in the orchard or garden, in quest of small insects or larvæ, spiders, etc. Sometimes they pursue and capture them on the wing. Their scrutinizing habits have obtained for them the name of wrens.

XII. FAMILY SYLVICOLIDÆ, (THE WOOD WARBLERS).

Genus *Anthus*. Titlark. Winter resident, frequent; gregarious; insectivorous; mostly affects plowed and bare fields on the margin of waters where it seeks various insects, seeds, etc.

Genus *Mniotilta*. Black and white creeper. Migratory, frequent; insectivorous. It lives principally on small ants and their larvæ, which it mostly gleans from the rough bark of orchard and forest trees.

Genus *Parula*. Blue yellow-backed warbler. Migratory, frequent; insectivorous; somewhat of a creeper; very active and useful in destroying small insects during the opening bloom of spring.

Genus *Protonotaria*. Prothonotary warbler. Summer resident, extremely rare; insectivorous; feeds on small insects, worms, caterpillars, etc.

Genus *Geothlypis*. Maryland yellow throat. Summer resident, frequent; insectivorous. Lives secluded in thickets and course tangled grass near streams where it feeds on small insects. Caterpillars and spiders form its principal food.—Mourning warbler. Summer resident, extremely rare; insectivorous; habits resemble the former.

Genus *Oporornis*. Connecticut warbler. Migratory, very rare; insectivorous. Audubon saw them chasing a species of spider which runs nimbly over the water, and which they caught by gliding over it.—Michener's warbler. Migratory, very rare; insectivorous; affects margins of woods, thickets, and old fences; keeps near the ground when seeking insects.—Kentucky warbler. Migratory, very rare north of Maryland; insectivorous. This species destroy great numbers of spiders. All the species are active insect hunters, and affect the woods and neighboring fields, orchards, and gardens.

Genus *Icteria*. Yellow-breasted chat. Summer resident, frequent; insectivorous; affects thickets, near water, and feeds on shelly-winged beetles, sometimes on berries and seeds.

Genus *Helmitherus*. Worm-eating warbler. Migratory, or very rare in summer; insectivorous. They are very active and indefatigable insect hunters.

Genus *Helminthophaga*. Blue-winged yellow warbler. Summer resident, rare, and very secluded; insectivorous. They feed on the eggs and larvæ of various insects, as well as flies, caterpillars, ants, and coleoptera.—Golden-winged warbler. Migratory, quite rare; insectivorous. This scarce bird is only seen in spring, when it frequents the tops of forest trees, and collects its food among the leaves and branches.- Nashville warbler. Summer resident, very rare; insectivorous. Its food consists of insects and larvæ, which it procures by searching actively and diligently among the leaves and buds of low trees.—Tennessee warbler. Migratory, very rare; insectivorous; an expert catcher of flies.

Genus *Seiurus*. Golden-crowned thrush. Summer resident, common in woods; insectivorous. Feeds wholly on insects and their larvæ. particularly small coleopterous kinds, and ants collected on the ground.—Water thrush. Migratory, frequent in marshy thickets; insectivorous. Feeds on such insects and their larvæ as inhabit marshy localities.—Large-billed water thrush. Migratory, more rare than the last; insectivorous. Very closely resembles the preceding species in appearance and habits.

Genus *Dendroica*. Black-throated green warbler. Migratory, rather rare; insectivorous. May be occasionally seen for an hour at a time carefully and actively searching for small caterpillars and winged insects amidst the white blossoms of the shady apple tree.—Black-throated blue warbler. Migratory, rare; insectivorous. An expert catcher of flies.—Yellow-rumped warbler. Migratory, abundant; insectivorous. Feeds on insects, etc.; is expert in catching flies, and is a great devourer of caterpillars.—Blackburnian warbler. Migratory, rather rare; insectivorous. An exceedingly nimble insect-hunter, keeping toward the tops of trees.—Bay-breasted warbler. Migratory, quite rare; insectivorous. Sometimes seen searching for insects along fences, etc.—Chestnut-sided warbler. Migratory, frequent; insectivorous. In the spring they are generally restless, and intently engaged in the chase of insects amidst the blossoms and tender leaves.—Blue warbler. Migratory, quite rare; insectivorous. Feeds principally on insects and their larvæ.—Black-poll warbler. Migratory, frequent; insectivorous. An active fly-catcher.—Yellow warbler. Summer resident, frequent; insectivorous. Feeds on the smaller insects, and a variety of small larvæ and caterpillars.—Nuttall remarks: It is amusing to observe the sagacity of this little bird in disposing of the egg of the vagrant cow troopial (genus *cassicus*). The egg being deposited before the laying of the rightful tenant, and too large for ejectment, it is ingeniously incarcerated in the bottom of the nest, and a new lining placed above it, so that it is never hatched, to prove the dragon of the brood.—Black and yellow warbler. Migratory, common; insectivorous. Very active in searching for their insect and larvæ food.—Cape May warbler. Migratory, extremely rare; insectivorous. Feeds on insect food, but its habits are little known.—Yellow red-poll warbler. Migratory, rare in swampy thickets; insectivorous. Industrious insect-eater.—Prairie warbler. Migratory, rare; found in open woods; insectivorous. Feeds on caterpillars and flies.

Genus *Myiodioctes*. Hooded warbler. Summer resident; very rare so far north, insectivorous. It flies swiftly after its insect prey, securing the greater part of it on the wing.—Green Black-capped warbler. Summer resident, very rare; insectivorous. It has all the habits of a true fly-catcher, feeding on small insects, which it catches entirely on the wing.—Canada warbler. Migratory, or summer resident, frequent; insectivorous. A truly insect catching species. Audubon says: I found it breeding in the pine forest.

Genus *Setophaga*. American redstart. Migratory, common in dense woods; insectivorous. He is no pensioner on the bounty of man. He does not wait the accidental approach of his insect prey, but, carrying the war among them, he is seen flitting from bough to bough, or at times pursuing the flying troop of insects from the top of the tallest tree, in a zig-zag, hawk-like manner to the ground.

Genus *Pyranga*. Scarlet tanager. Summer resident, frequent in woods; omnivorous. Its food consists chiefly of winged insects, wasps, hornets, and wild bees, as well as smaller kinds of beetles, and other shelly tribes. He rarely visits the orchard and tastes the early and inviting, though forbidden cherries.—Summer redbird. Summer resident, rare; omnivorous. Habits very similar. Both species become more fructivorous in autumn.

XIII. FAMILY HIRUNDINIDÆ, (THE SWALLOWS).

Genus *Hirundo*. Barn swallow. Summer resident, very abundant; insectivorous. Its food consists entirely of insects, some being small coleoptera. The swallows, like the swifts feed entirely on the wing, and thus devour vast numbers of flying insects, which otherwise might annoy us.—Cliff swallows. Summer resident, now become frequent; gregarious; insectivorous. Its feeding proclivities are, as a general rule, similar to the barn swallow. Its curious, bottle-shaped mud tenements may now be seen beneath the eaves of buildings in several localities.—White-bellied swallow. Summer resident, frequent; insectivorous. Like all other swallows, it feeds on the wing, unceasingly pursuing insects of various kinds. Once the tenant of the forest, it is fast changing its habits, and in some parts has taken possession of martin-boxes in preference to hollow trees.

Genus *Cotyle*. Bank swallow. Summer resident, abundant. gregarious, insectivorous. The bank swallow builds in holes excavated in the sandy, steep banks of creeks, etc.; hence is more frequent near watercourses, and, consequently, feeds on such insects as inhabit them. Its food which consists of small insects, principally of the hymenopterous kind, is taken on the wing.—Rough-winged swallow. Summer resident, frequent; insectivorous. Closely resembling the preceding species, and often associated with it in the same community, until recently the two appear to have been confounded.

Genus *Progne*. Purple martin. Summer resident, abundant, gregarious and insectivorous. Familiarly domiciled in the martin-box, our bird seems specially commissioned to rid the neighboring premises of noxious insects. The food of the martin is usually the larger winged insects, as wasps, bees, large beetles. such as the common *Cetonias* or goldsmiths, which are swallowed whole. They seldom seize the honey bee.

XIV. FAMILY BOMBYCILLIDÆ, (THE WAX-WINGS).

Genus *Ampelis*. Cedar bird, cherry bird. Resident, common, rare in winter; granivorous; an eminently fructivorous species, as its common name implies. Too well known to fruit growers as the cherry bird, yet, as an amende honorable he feeds in spring on small caterpillars, beetles, and small insects. For hours together he may be seen feeding on the all-despoiling canker worm, which infests our apple and elm trees.

XV. FAMILY LANIIDÆ, (THE SHRIKES).

Genus *Collyrio*. Butcher bird. Winter resident, rare; insectivorous. Fond of crickets, grasshoppers, and various insects. In winter, when these become scarce, he grows more predacious, seizing small birds, mice, etc., with the vigor and dexterity of a hawk; to which its robust form and hooked bill give it some resemblance.

Genus *Vireo*. Red-eyed vireo. Summer resident, frequent; insectivorous. Its food consists of insects and their larvæ, especially caterpillars. He is an animated and melodious songster. Wantonly to destroy these delightful aids to sentimental happiness, ought to be viewed not only as an act of barbarity, but almost as a sacrilege.—Warbling vireo. Summer resident, frequent; insectivorous. The principal food of this species consists of small black caterpillars off the poplars. The most familiar of the vireos, it approaches the orchard and garden, where it carefully searches for insects among the leaves and branches of the trees.—White-eyed vireo. Summer resident, not common; insectivorous. Like its kindred, its food in spring consists of insects; in autumn, berries are added to its bill of fare.—Blue-headed vireo. Summer resident, rather scarce; insectivorous. Its food consists of insects and berries.—Yellow-throated vireo. Summer resident, not common; insectivorous. Habits similar to those of the preceding species.

XVI. FAMILY LIOTRICHIDÆ.

Genus *Mimus*. Mocking bird. Summer resident, rare; omnivorous. Insects, worms, grasshoppers, and larvæ are the food on which they principally subsist; in winter, on the berries of the red cedar wax myrtle, holly, etc. They are eminently vocal.—Cat bird. Summer resident, abundant; omnivorous. This songster, which rivals even the mocking bird itself, and feeds during a large part of the season on the very insect races which are injuring the crops of the cultivator, is often greatly persecuted. The vulgar name which it bears has served to bring it into contempt with persons not the best judges of the benefits it confers on the husbandman in early spring, when with industrious care it cleanses his fruit trees of thousands of larvæ and insects, which in a single day would destroy, while yet in the bud, far more of his fruit than the cat bird would eat in a whole season. But alas! selfishness, the usual attendant of ignorance, not only heaps maledictions on the harmless bird, but dooms it to destruction. The boys pelt it with stones and destroy its nest whenever an opportunity presents; the farmer shoots it to save a pear, the gardener to save a raspberry; and some hate it not knowing why. In a word, excepting the poor crow, there is no bird more generally despised and tormented than this charming songster.

Genus *Harporhynchus*. Brown thrush. Summer resident, common; omnivorous. This is another mimic rival of the mocking bird. Its food consists of worms and insects generally; also caterpillars, beetles, and other coleopterous tribes, as well as various kinds of berries. He may scratch a few hills of corn or plunder a few cherries, but rest assured that his services have already paid for these; and his music, while it is sweeter, will cost less than that of the flute or the piano.

Genus *Thryothorus.* Carolina wren. Resident, frequent; insectivorous. This has much the habit of the common house wren, exploring dark nooks and corners, and piles of wood, brush, etc., where it finds spiders, moths, and other insects in abundance. Its powers of song and mimicry are excelled by few birds.—Bewick's wren. Resident; insectivorous; nearly related to the foregoing, its habits are very similar, feeding on spiders, moths, and other insects.

Genus *Cistothorus.* Long-billed marsh wren. Summer resident, frequent about marshes; insectivorous. Feeds on aquatic insects and others which frequent wet places. —Short-billed marsh wren. Summer resident, frequent; insectivorous. Habits similar to the preceding. Secluded among the brushwood and rank grass of their favorite swamps, they elude observation.

Genus *Troglodytes.* House wren. Summer resident, common: insectivorous. Our bird keeps up frequent squabbles with his neighbors, like other busybodies that are never happy but in mischief. He is still, upon the whole, a real friend to the farmer and horticulturist, by the number of injurious insects and their destructive larvæ, on which he and his numerous family subsist.—Wood wren. This is perhaps too near the preceding species to warrant a separate notice.—Winter wren. Winter resident, frequent; insectivorous. Its habits are much like those of the house wren; but is distinguished by season, the length of the tail, and the food which season may afford.

XVII. FAMILY CERTHIIDÆ, (THE CREEPERS).

Genus *Certhia.* American creeper. Resident, frequent, but eludes observation; insectivorous. Its food consists chiefly of ants, larvæ, and small insects, and small particles of lichens; and if one be placed near the nose, it is generally found to emit an odor like that of ants.

Genus *Sitta.* White-bellied nuthatch. Resident, frequent; insectivorous. It searches and shells off the bark, in quest of his lurking prey of spiders, ants, insects, and their larvæ in general.—Red-bellied nuthatch. Winter resident, rare in forests; insectivorous. The scarcity of insect food in winter often obliges our sojourner to resort to the seeds of the pine for subsistence.

XVIII. FAMILY PARIDÆ, (THE TITMICE, ETC.).

Genus *Polioptila* Blue-gray fly-catcher. Resident, frequent in summer; insectivorous. A very dextrous, lively insect-hunter; among other small insects, it preys on the troublesome mosquitoes

Genus *Lophophanes.* Tufted titmouse. Resident, frequent; insectivorous. This well known species seeks its food in summer in crevices and among rotten wood; in winter it has recourse to seeds and small berries, in addition to refuse from the kitchen and garbage from the butcher's stalls.

Genus *Parus.* Black-capped titmouse. Resident, frequent; insectivorous. Feeds on insects, their larvæ, and eggs of destructive moths; especially those of the canker worm, as well as every sort of small fruits, berries, and seeds.—Carolina titmouse. Summer resident, rare; insectivorous. Has the habits of the black-cap.

XIX. FAMILY ALAUDIDÆ, (THE LARKS).

Genus *Eremophila.* Shore lark. Winter resident, frequent; granivorous. Their food consists of various kinds of seeds which remain on the grass and weeds, and the eggs and dormant larvæ of insects when they fall in their way.

XX. FAMILY FRINGILLIDÆ (THE SPARROWS).

Genus *Pinicola.* Pine grosbeak. Winter resident very rare; granivorous. Its food consists of buds and seeds of almost every sort of trees, and occasionally a passing insect.

Genus *Carpodacus.* Purple finch. Winter resident, frequent; granivorous. Its food is chiefly seeds and berries of red cedar, etc., with a sprinkling of insects and larvæ.

Genus *Chrysomitris.* American goldfinch. Resident, common; rare in winter; granivorous. Its food consists of many kinds of small seeds, especially of the thistle, lettuce, and other composite plants. Many pernicious seeds are thus destroyed.—Pine finch. Winter resident, rare; granivorous. Consumes the seeds of the thistle and allied plants, and those of the pine tree.

Genus *Curvirostra.* Red crossbill. Winter resident, very rare out of the pines; granivorous. Affects pine forests, the peculiar structure of its bill having a peculiar adaptation for extracting seeds from the cones.—White-winged crossbill. Winter resident, rare away from pine woods; granivorous. Same habits with the preceding species.

Genus *Ægiothus.* Lesser red-poll. Winter resident, very rare; granivorous. Feeds on various small seeds, especially of the alder, buds of the maple, etc.

Genus *Plectrophanes.* Snow bunting. Winter resident, very rare; granivorous. Feeds on various seeds, grains, and small insects. Mingles with the snowbird in its familiar visits to the garden and house yard to glean the refuse from the kitchen. It is then noted as the white snowbird.—Lapland longspur. Winter resident, very rare; granivorous. Its food consists chiefly of seeds, and also of grass, leaves, buds, and insects.

Genus *Passerculus.* Savanna sparrow. Summer resident, common; granivorous. It subsists on various grass and other seeds, with such small insects and larvæ as may fall in its way.

Genus *Poocætes.* Bay-winged bunting. Resident, common in summer, rare in winter; granivorous; feeds on the seeds of grasses and a spice of the more savory insects. In search of the latter it sometimes visits plowed fields.

Genus *Coturniculus.* Yellow-winged sparrow. Summer resident, frequent; granivorous; dwells among grass, where its food, the grass-seeds, is abundant. It delights to add a few insects to its common fare.—Henslow's sparrow. Summer resident, very rare; granivorous; habits similar to those of the preceding species.

Genus *Zonotrichia.* White-crowned sparrow. Winter resident, not common; granivorous; subsisting on grass-seeds, berries, coleopterous insects, etc.—White-throated sparrow. Winter resident, frequent; granivorous; habits similar to the last.

Genus *Junco.* Snowbird. Winter resident, very numerous; granivorous. Every one must be familiar with this little accompaniment of cold and storm, as it picks its scanty fare of grass and other seeds from the lawn, the garden, or the yard, wherever the winds or the housewife's broom have left the ground uncovered with snow.

Genus *Spizella.* Tree sparrow. Winter resident, frequent; granivorous. Sometimes seen during winter in company with the snowbird, and feeding in a similar way. Field sparrow. Resident, common in summer; granivorous. The food of this species consists of seeds and insects. They search the leaves and branches for moths, of which they seem to be fond.—Chipping sparrow. Summer resident, very common; granivorous. Its habits resemble those of other small sparrows; but being confiding and self-domesticated, it feeds and breeds among the trees and shrubbery in our orchards, gardens, and yards, and even boldly crosses the threshold to pick the crumbs which accident or design may have thrown in its way.

Genus *Melospiza.* Song sparrow. Resident, common; granivorous. This lovely songster dwells in the orchard and garden, where it subsists on small seeds and insects. In winter it often associates with the snowbird, and exhibits the same familiar habits. Its song is one of the earliest harbingers of spring. —Lincoln's sparrow. Migratory; extremely rare; granivorous; habits resemble those of the former species; feeds on seeds, berries, and insects. —Swamp sparrow. Migratory, frequent in proper localities; granivorous. Feeds principally on the seeds of grasses, with a few insects.

Genus *Passerella.* Fox-colored sparrow. Winter resident, frequent; granivorous. During their winter sojourn they frequent brier patches and thickets to search among the fallen leaves for seeds and the remains of insects, larvæ, etc.

Genus *Euspiza.* Black-throated sparrow. Summer resident, common; granivorous. Their food consists of seeds, eggs of insects, and in the early part of summer of caterpillars and small coleopterous insects.—Townsend's sparrow. Summer resident, unique; granivorous. Its food inferred from analogy to be, as in other sparrows, seeds and insects.

Genus *Guiraca.* Rose-breasted grosbeak. Summer resident, very rare and recluse; granivorous. The food of this beautiful bird consists of the seeds of cereal plants, of grasses, and those of different kinds of berries, along with insects, etc.—Blue grosbeak. Summer resident, very rare; granivorous. They feed on grains, hemp-seed, millet, and the kernels of different sorts of berries.

Genus *Cyanospiza.* Indigo bird. Summer resident, frequent; granivorous. The usual food of this species is insects, and various kinds of seeds.

Genus *Cardinalis.* Cardinal grosbeak. Resident, frequent; granivorous. Indian corn constitutes their chief and favorite food, when attainable. The seeds of apples, cherries, and of many other sorts of fruit, are also eaten by them.

Genus *Pipilo.* Towhee bunting. Summer resident, common; granivorous. He scratches continually among fallen leaves along the fences, in thickets, and brier patches, in quest of the seeds, and worms, etc., which are concealed there.

XXI. FAMILY ICTERIDÆ.

Genus *Dolichonyx.* Reedbird, bobolink. Migratory, frequent in season; granivorous. The reed or wild rice of all our tide water marshes is, in autumn, the essential food of this bird. To this may be added grain and grass-seeds generally, with insects of various kinds, grubs, mayflies, and caterpillars. They sometimes collect in very numerous flocks, and if they happen to alight on a grain field, either ripe for harvest or newly sown, the farmer, to use the language of Wilson, may look upon them as a devouring scourge, and worse than a plague of locusts

Genus *Molothrus.* Cow blackbird. Summer resident, abundant; omnivorous. To the ordinary habits of the common blackbird it adds that of following cattle in the pasture. to feed on the insects which are attracted by their ordure. Some say it is to feast on the intestinal worms dropped by the cattle at certain seasons of the year. The cow buntings have ever been a race of foundlings. They are remarkable for a total want of the natural instincts of maternity. They do not provide themselves a nest; they never incubate their own eggs; they feel no parental care for their young, which they never nurse. Like the European cuckoos, they possess a wonderful degree of instinctive cunning in employing the maternal instincts of other birds for the performance of their own parental duties, which they ignobly refuse to render. The offspring of the foster-mother is generally sacrificed in her attempt to raise the foundling of another

Genus *Sturnella.* Meadow lark. Resident, common; omnivorous. Their food consists of caterpillars, grubworms, beetle. and grass-seeds.

Genus *Icterus.* Orchard oriole Summer resident, frequent; insectivorous. I have good reason for believing that the species of insects on which he feeds are almost altogether such as commit the greatest depredations on the fruits of the orchard.—Baltimore oriole. Summer resident, frequent; insectivorous. Their food consists of worms, caterpillars, beetles, and bugs, particularly one of a brilliant glossy green, (the goldsmith). In autumn both species partake of seeds and small berries.

Genus *Scolecophagus.* Rusty blackbird. Migratory, frequent; omnivorous. They feed on grasshoppers and other insects, berries, etc., and in autumn, on corn.

Genus *Quiscalus.* Crow blackbird. Summer resident, very abundant; omnivorous. Every industrious farmer complains of the mischief committed on his corn by the crow blackbird. But were I, placed in his situation, I should hesitate whether to consider these birds most as friends or enemies, as they are particularly destructive to almost all the noxious worms, grubs, and caterpillars that infest his fields; which, were they allowed to multiply unmolested. would soon consume nine-tenths of all the production of his labor, and desolate the country with the miseries of famine.

XXII. FAMILY CORVIDÆ, (THE CROWS).

Genus *Corvus.* Raven. Resident, now very rare or extinct; omnivorous. Audubon writes: The more intelligent of our farmers are well aware that the raven destroys numberless insects, grubs, and worms; that he kills mice, moles, and rats whenever he can find them; that he will seize the weasel, the young opossum and the skunk; that, with the perseverance of a cat, he will watch the burrows of the fox, and pounce on the cubs. Yes, good reader, the farmer knows all this well, but he also knows his power, and, interfere as you may, with tale of pity or of truth, the bird is still a raven.—American crow. Resident, very abundant; omnivorous. This more familiar epitome of the raven is known to every one. Our crow feeds on fruits, seeds, and vegetables of almost every kind; it is equally fond of snakes, lizards, frogs, and other small reptiles. It looks upon various species of worms, grubs, and insects as dainties; and, if hard pushed by hunger, will devour even putrid carrion. It is fond of the eggs of other birds, and it plunders the fields of their superabundance. It is blamed for so doing, but seldom praised when it chases the thieving hawk from the poultry yard. With such a ledger it is often difficult for the farmer to settle the accounts with his tenant to mutual satisfaction —Fish crow. Resident, rare; omnivrous. The fishing habits of this crow lead it more about the water, where it finds many aquatic insects, reptiles, etc.; otherwise it is a mere epitome of its older brother.

Genus *Cyanura.* Blue jay. Resident, common; omnivorous. This gay and gaudy bird has very much the same habits as its more sombre relatives, the crows. Like them his organs of destructiveness and acquisitiveness are very large, without a sufficient balancing power. He is both cruel and dishonest. He feeds indiscriminately on flesh, reptiles, insects, seeds and fruits.

XXIII. FAMILY COLUMBIDÆ, (THE PIGEONS).

Genus *Ectopistes.* Wild pigeon. Wandering; at times very abundant and gregarious; granivorous; feeds on beech mast, acorns, grains and seeds of various kinds. It sometimes attacks the newly sown grain of the farmer, and when the flock is large does much injury.

Genus *Zenaidura.* Turtle dove. Resident frequent; granivorous. It feeds on small acorns, various kinds of grains and seeds; also on the fruits of the dogwood, holly, poke, etc.

XXIV. FAMILY PHASIANIDÆ, (THE TURKEYS).

Genus *Meleagris.* Wild turkey. The turkey in a wild state feeds on nuts, acorns, grains, and berries, together with various insects tadpoles. lizards, etc. The domestic bird has the same habits, but feeds especially on grasshoppers and the seventeen-year locust when abundant on which they become fat. The great destruction of insect pests by turkeys, added to their market value, makes them a profitable crop for the farmer.

XXV. FAMILY TETRAONIDÆ, (THE GROUSE).

Genus *Cupidonia.* Pinnated grouse. Their food consists of acorns, of the dwarf-oaks, fruits and berries, and the buds of trees, especially the apple tree, and sometimes insects, such as grasshoppers, etc. Audubon says: I have counted more than fifty on a single apple tree, the buds of which they entirely destroyed in a few hours.

Genus *Bonasa.* Ruffed grouse, pheasant. Resident, frequent; granivorous. The habits and food are very similar to those of the pinnated grouse. During the snows of winter, when their favorite berries have been exhausted. or are concealed, they feed on various buds, etc., and may then be found in the trees of the apple orchard.

Genus *Ortyx.* Partridge, quail. Resident, common; granivorous. The food of the partridge consists of grain, seeds, insects, and berries of various kinds. Buckwheat and Indian corn are particular favorites. In winter it becomes more familiar, and sometimes enters the farmyard to feed with poultry.

XXVI. FAMILY ARDEIDÆ, (THE HERONS).

Genus *Botaurus.* American bittern. Resident, not common; piscivorous. The habits and food of this bird do not appear to differ essentially from the last.

Genus *Butorides.* Green heron. Summer resident, frequent; piscivorous. Small fish and frogs are his principal food, with small reptiles and aquatic insects.

XXVII. FAMILY CHARADRIIDÆ, (THE PLOVERS).

Genus *Charadrius.* Golden plover. Migratory, frequent; insectivorous; feeds on insects, worms, grasshoppers, small shell fish, and sometimes a few seeds and berries according to season.

Genus *Aegialitis.* Killdeer plover. Resident, or nearly so frequent; insectivorous; feeds on various insects, grasshoppers, snails, and worms.

Genus *Squatarola.* Black-bellied plover. Summer resident, rare; insectivorous; feeds on insects, water snails, worms, and in season on small berries.

XXVIII. FAMILY SCOLOPACIDÆ, (THE SNIPES).

Genus *Philohela.* Woodcock. Resident, frequent; insectivorous. The food of the woodcock consists principally of earth worms and such other insects and worms as occur under fallen leaves and in soft bogs, which it probes with its long slender bill, and which is so sensitive at the tip as to enable the bird to discover and drag out its prey.

Genus *Gallinago* Wilson's snipe. Summer resident. or very rare in winter; insectivorous. They continually bore in marshes, like the woodcock, for food, which appears to consist of worms, leaches, and water spiders.

Genus *Gambetta.* Tell-tale tattler. Summer resident, not frequent; insectivorous; affects marshy meadows and margins of streams. Feeds on small fish, insects, worms, water snails, etc.—Yellowshanks tattler. Summer resident, frequent; insectivorous; nearly related to the last. Feeds on fishes, shrimps, worms, and aquatic insects.

Genus *Rhyacophilus.* Solitary sandpiper. Summer resident; insectivorous. Feeds on caterpillars, water insects, spiders, etc., etc.; mostly found about muddy ponds and ditches.

Genus *Tringoides.* Gray-spotted sandpiper. Summer resident, common; insectivorous. Feeds on insects and worms, which it often seeks by probing the marsh mud.

Genus *Actiturus.* Bartram's sandpiper. Summer resident, frequent; insectivorous. Feeds on coleopterous insects, crickets, grasshoppers, and sometimes on the seeds of grasses.

ORRIS. *Iris florentina.* The root of this flag is remarkably fragrant, and used in powder as a dentifrice. It is readily cultivated in moist, light soils, and grows rapidly from offsets.

ORTHOPNŒA. Difficulty of breathing, especially when lying down.

ORTHOPTERA. The name orthoptera signifies straight wing, as the generality of insects of this order are distinguished by having their under wings folded in straight plaits, and not doubled up under the wing-cases, as in the coleoptera or beetles. When the insect is at rest the under wings are folded longitudinally, or lengthwise, in long, narrow plaits, diverging from a common center at the root of the wing near the body, like a fan; these plaits gradually grow wide as they approach the circumference. When closed, the under wings are concealed under the upper wings, but when in flight they are expanded to the utmost, also in the manner of a fan. The insects of this order are furnished with strong and powerful jaws for biting their food, which consists principally of vegetable substances, leaves, blossoms, and sometimes fruits, and as their digestive organs are also well developed, and as they feed voraciously in larva, pupa, and perfect stages, the injuries they are able to inflict upon the farmers are sometimes almost incredible. Take, for example, the Western grasshoppers, which migrate in innumerable numbers, and sometimes in a single day will destroy the produce of a whole region. As soon as the eggs are hatched the young insects of this order begin to eat, and are in form almost exactly like the perfect insects, with the exception of having no wings. They shed their skins several times before arriving at maturity; as pupæ they acquire rudimentary wings, or wing-sheaths, and it is only as the perfect insect that they acquire perfect wings and are able to fly. There are, however, several species of the orthoptera which never acquire any wings whatever, but during their whole existence are obliged to leap, walk, or crawl, either wholly wingless, or with rudimentary wings only, which are of no use for purposes of flight. Cockroaches, crickets, grasshoppers, etc., belong to this order of insects.

ORTHOTROPORES. Seeds in which the hilum and foramen are opposite.

ORTOLAN. A bird of passage of the family *Fringillidæ.* They migrate from Africa to Southern Europe, and are fattened for the tables of the wealthy.

ORYZA. The genus to which rice belongs.

OSCILLATION. Movement similar to that of the pendulum.

OSCILLATORIA. Plants of the lowest organization, living in wet or damp places, and consisting of threads, which have sometimes an apparent movement.

OSMAZOME. The brown, fragrant extractive matter of roasted meats.

OSMIUM. A rare metal, associated with platina in ores.

OSSEOUS BRECCIA. Fragments of bones and mineral matters found cemented together in some caverns and fissures of rocks.

OSSIFICATION. The process of the deposition of bone.

OSTEOLOGY. A dissertation on bones.

OSTITIS. (See Spavin).

OTITIS. Inflammation of the internal parts of the ear.

OTTO, or ATTAR OF ROSES. A perfume, the essential oil of roses. The fresh flowers are distilled with water by a gentle heat, as in the case of other essences.

OUNCE. In troy weight, 480 grains, one-twelfth of a pound; in avoirdupois, one-sixteenth of a pound; it contains only 437½ troy grains.

OURARI. A virulent poison from the *Strychnos toxifera,* of Guiana. It produces convulsions and suspended animation.

OUTCROP. In geology, the exposure of rocks or strata above the earth.

OUTFALL. The lower end of a water-course.

OUTFIELD. Unenclosed lands, distant from the homestead.

OUTLIER. The detached portion of rock, distant from the mass.

OUZE. The muddy deposits of the sea, or waters.

OVARIA. The oval bodies which contain the eggs, or germs, in female animals.

OVARIUM. In plants, a hollow case, enclosing ovules or young seeds, containing one or more cells, and ultimately becoming the fruit; it is always situated in the center of the flower, and, together with the style and stigma, constitute the female system of the vegetable kingdom. When it is united to the calyx, it is called inferior; when separate from it, it is termed superior.

OVERLAND FARM. Without buildings.

OVERREACH. This is an injury to the coronet of a fore foot, by striking with the hind shoe, in traveling. Interfering is an injury of one fetlock by a blow of an opposite shoe, caused by setting the foot to which the injury is done out of line. Overreach, when it is a natural disability, may be prevented by making the forward shoes heavier than the hinder ones.

OVERSHOT WHEEL. That form in which the water falls from above the wheel upon the upper parts.

OVIDUCT. Fallopian tube, a membranous tube which conveys the germs, or eggs, from the ovarium into the womb, or out of the body.

OVINATION. Vaccination of sheep. It is sometimes practiced when the small pox of sheep, *variola ovina,* is ripe; but thorough isolation is the better course.

OVIPAROUS. Producing eggs. Birds, serpents, insects, and fishes are usually oviparous.

OVIPOSITOR. A pointed tube whereby many insects deposit their eggs in holes or chinks.

OVIS. The generic name of the sheep. The Mouflons are supposed to be the original of our domestic animal, but this is questionable.

OVIVIPAROUS. Producing living young, enclosed within an egg-like membrane; the marsupials, the viper, flesh fly, and several mollusks, are instances.

OVULUM. In botany, the rudimentary seed before impregnation.

OWL. (See Ornithology.)

OX. The gelded males of neat cattle are called oxen. These, until they have attained their growth and full development, are called steers. For all purposes of human food the steers are preferable. For draft the mature animals—oxen—are preferred. The proper age at which to geld the males depends upon whether they are intended for their flesh or labor, if for the former, the earlier the better. It is generally performed at the age of four to six weeks, and seldom delayed later than the age of two months. If the animals are intended for labor, it would undoubtedly be better that the operation be performed at one year old, but since the animal is to serve as food when no longer serviceable for labor, and since the animal gelded at one year old is more or less staggy, gelding is usually performed at the age first mentioned. By butchers, drovers, and feeders, any male of the cow kind, gelded at one year old or older, is termed a stag.

OXALIS. The genus of wood sorrels. The *O. crenata* is a perennial, ornamental plant, native of Chili. The flowers are yellow, and in umbels; the stalks and leaves are succulent and acid.

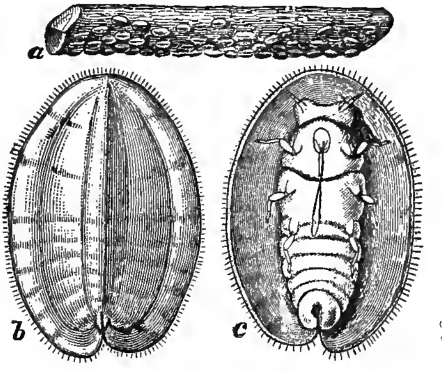
OX EYE. The genus *chrysanthemum.* Weeds growing among wheat and small grain, with large white and yellow composite flowers.

OXYCHLORIDES. Compounds of chlorine with metallic oxides, as bleaching salt.

OXYGEN. This important element was discovered in 1774 by Dr. Priestley. There are several compounds of oxygen which, when exposed to heat, are decomposed, and yield the gas in a state of purity. Of these, the best is chlorate of potash; but as that salt is expensive, we generally resort to black oxide of manganese, which at a dull-red heat, gives out a considerable quantity of tolerably pure oxygen gas. Oxygen gas is colorless, tasteless, and inodorous, it is electro-negative, and therefore, when compounds containing it are electrically decomposed, it always appears at the positive surface. It is a little heavier than atmospheric air, in the proportion of eleven to ten; 100 cubic inches weighing 34.18 grains. It is absorbed by water to the extent of less than one per cent., and is neither acid nor alkaline. It has a powerful attraction for most of the simple substances, especially for the electro-positive bodies. The act of combining with it is called oxidation. The compounds thus formed are divided into acids and oxides; among the latter are the alkalies, and almost all salifiable bases. Oxidation is often attended with the evolution of heat and light, as in all processes of combustion in atmospheric air; sometimes it is slow, and unattended with such phenomena, as in the gradual rusting of metals. Oxygen is a most powerful supporter of combustion; it constitutes one-fifth of the bulk of the atmosphere, and is the principle which enables combustible bodies to burn in it. The product of combustion, that is, the oxide, or acid, is sometimes itself gaseous, as when charcoal, by burning is converted into carbonic acid; or it is liquid, as hydrogen, by combustion, produces water; or it is solid, as when iron, by burning, produces oxide of iron. Oxygen gas is also essential to respiration; that is, to the evolution of carbonic acid from the blood; but requires to be diluted with nitrogen, as in the air, otherwise it destroys life by producing over-activity. Seeds can not germinate without oxygen, and are, therefore not to be buried too deep in a compact soil. The leaves of trees, also, can not perform their functions without its presence, although they are always exhaling a large quantity of this gas. Oxygen is very extensively diffused in nature; in the compound state it forms eight-ninths of all waters, and at least one-half of all structures, whether mineral or organic, except a few oils and resins.

OXYURES. A family of hymenopterous insects with an external ovipositor resembling a tail. They are pupivorous, and prey on other insects. A genus of intestinal worms, also.

OYSTER SHELL BARK LOUSE. The Oyster shell bark louse, (*Aspidiotus conchiformis,*) is often destructive to young orchards if neglected, fastening themselves in countless numbers on the young bark of the twigs and smaller limbs, and thus sapping the life of the tree by sucking its juices. This is an imported species, not originally a native of America. The native bark louse (*A. Harisii*) does comparatively little damage. The cut shows the manner in which the insect attaches itself to a limb at *a*, natural size; *b*, and *c*, show Maple Louse highly magnified, the former a dorsal, and the latter a ventral view. Dr. Riley renamed this insect in 1873 *Mytilaspis pomicortis,* retaining the popular name, although the case under which the insect lives is usually more of the form of the mussel than the oyster. Once the insects are firmly fixed to the bark under their covering, remedies, except slowly scraping them away are of but little value. The proper time to attack them is in June, or at the time when the young hatch, and crawl forward to seek new quarters. Then any alkaline wash or strong soap suds readily kills them. They are active, however, but a few days, and should be closely watched. Fortunately they have many parasitic enemies, so that with a little attention at the right season they are easily kept down, and once an orchard is cleared, it is generally for good, unless infested trees are planted in, for as is well known they are incapable of moving far, unless carried. Harris says the body of the female insect, which is covered and concealed by the outer case, as shown above, is minute, of an oval form, wrinkled at the sides, flattened above, and of a reddish color. By means of her beak, which is constantly thrust into the bark, she imbibes the sap, by which she is nourished; she undergoes no change, and never emerges from her habitation. The male becomes a chrysalis or pupa, and about the middle of July completes its transformations, makes its escape from its case, which it leaves at the hinder extremity, and the wings with which it is provided are reversed over its head during the operation, and are the last to be extricated. The perfect male is nearly as minute as a point, but



MAPLE BARK LOUSE.

a powerful magnifier shows its body to be divided into segments, and endued with all the important parts and functions of a living animal. To the unassisted eye, says Dalman, it appears only as a red atom, but it is furnished with a pair of long whitish wings, long antennæ or horns, six legs with their respective joints, and two bristles terminating the tail. This minute insect perforates the middle of the case covering the female, and thus celebrates its nuptials with its invisible partner. The latter subsequently deposits her eggs and dies. In due time the young are hatched and leave the case; under which they were fostered, by a little crevice at its hinder part. These young lice, to the naked eye, are very small, of a pale yellowish brown color, and of an oval shape, very flat, and appearing like minute scales. They move about for a while, at length becoming stationary, increase in size, and in due time the whitish shells are produced, and the included insects pass from the larva to the pupa state. The means for destroying these insects are the same as those recommended for the extermination of the previous species.

OZŒNA. A putrid discharge from a fetid ulcer of the nostril or nostrils.

OZONE. (See nitrogen.)

P

PACHYDERMATA. The order of quadrupeds with thick hides, as the horse, elephant, ox, pig, etc.

PACING, AMBLING. A natural pace of the horse, in which both legs of one side are raised at a time.

PADDLE-STAFF. An instrument used by plowmen to free the share from clinging earth,

PADDOCK. A small field or enclosure.

PAGINA. The flat surface of the leaf.

PALATE. The roof of the mouth. It is divided into hard or bony palate, and soft palate, the latter being the membrane at the innermost portion. The shape and markings of the palate are adduced by zoologists in their descriptions. The elevated portion of the lower lip of a personate flower.

PALEÆ CHAFF. A name given to the bracts that are stationed upon the receptacle of compositæ between the florets, and having generally a membranous texture and no color; also the interior bracts of the flowers of grasses.

PALMA CHRISTI. The castor-oil plant.

PALMATE. Resembling the hand, five-lobed or toothed.

PALMETTO. Exotic trees containing many species, valuable for their fruit, fiber, oil, etc., as the cocoa-nut, date, cabbage, sago, etc. The palmetto of the Southern States is valuable for many purposes, as making paper, etc. Its leaves and roots are also applied to useful purposes.

PALMIPEDES. The anseres, or swimming birds of Linnæus.

PALM OIL. Oil of several of the palm trees, especially that of *Elais Guinensis.* Palm tree,

PALMS, PALMACEÆ. A natural order of arborescent endogens, like the palmetto, chiefly inhabiting the tropics, distinguished by their fleshy, colorless, six-parted flowers, enclosed within spaths, and rigid plaited or pinnate inarticulated leaves, sometimes called fronds. They yield bread, oil, wine, cordage, fuel, and all necessaries to the savages of the tropics.

PALP, PALPUS. The jointed organs attached to the labium and maxilla of insects; the feelers.

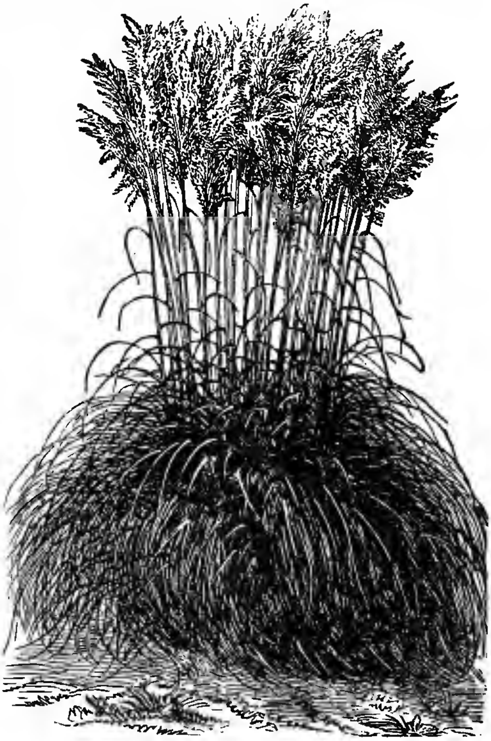
PALPATORS. Clavicorn beetles with long palpi, or feelers.

PALUSTRINE, PALUSTRIS. Marshy, belonging to a marsh.

PAMBINA. A species of high cranberry, found near the Columbia river.

PAMPAS. South American prairies.

PAMPAS GRASS. *Gynerium argenteum.* This is one of the very finest ornamental grasses in cultivation. Its immense size, superb, feathery spikes and thick bottom of foliage making it as conspicuous as it is beautiful, as a single specimen on a lawn. It is a native of the Pampas of South America, whence it has been introduced to various parts of the world. Wherever known it has been universally admired. Unfortunately it is not hardy north of about 38°, and not at all in the West. When it is planted it should be protected by a covering sufficient to preserve the ground from freezing. A good way is to place a frame about the plant, cover it inside with evergreen boughs, and then strew thickly with litter and horse manure over the whole, banking the frame well up. (See Ornamental Grasses.)



PAMPAS GRASS.

PAN. A term applied to the bed or flooring upon which the cultivated soil lies or is placed;

used only in a limited sense by some greenhouse men, or to designate a very compact subsoil.

PANACEA. A universal and fabulous remedy.

PANCREAS. The sweet bread. It is composed of innumerable small glands, the excretory ducts of which unite and form one duct, called the pancreatic duct, that conveys a fluid very similar to saliva into the intestines, called the pancreatic juice, which mixes with the chyle in the duodenum.

PANE OF GROUND. An old term for a small, four-sided piece of ground capable of irrigation.

PANDURIFORM. Fiddle-shaped or like a guitar.

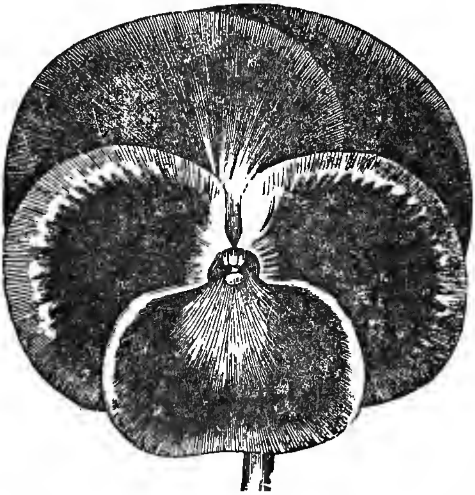
PAN-FEEDERS. In horticulture, the shallow vessels in which pots are set.

PANIC GRASS. The genus *Panicum.* Coarse annuals, of little value for grass. *P. miliaceum* is one variety of millet.

PANICLE. A kind of inflorescence, in which the central stalk throws out lateral stems, and these bear the petioled flowers, as in oats.

PANNAGE. The food consumed by hogs in woods.

PANSY. Heart's-ease. *Viola tricolor.* The pansy is a biennial plant, but blooming in autumn of the first year if sown early. In the North the plants should be protected in winter with litter and brush, but the litter should not press directly on the plants, else they are liable to smother. The colors of pansies are various and beautiful from almost pure white to a maroon purple which looks black. The perfection of form in the pansy is that the blooms shall be round, flat, and distinctly marked as shown in the cut. When extra fine pansies are desired, great care is taken in fertilizing the flowers and saving the seed. Hence the high price not only of such seeds, but of all other especially high grades of choice flower seeds. Pansies require a rich but thoroughly drained soil, (sandy loam is best). Sow the seeds early in the spring, or better in March, in a hot bed and prick out, two inches apart when large enough. The middle of May, transplant in the border or bed six inches apart, and you will have abundance of bloom, some varieties come measurably true to name if care is taken in saving the seed.



PERFECT PANSY.

PAPAVERACEÆ. Plants allied to the poppies; they are for the most part narcotics.

PAPAW. *Asimina triloba.* A tree, or rather large shrub, bearing edible, oblong, pulpy fruit, something resembling the banana. The tree grows sometimes to the height of thirty feet, with a stem six inches in diameter. From western New York to Northern Illinois it is rare, except in particular locations, but farther south is quite common. The flowers and foliage of the tree are very handsome, but the fruit is not generally liked.

PAPILIONACEOUS PLANTS. The *Leguminosæ,* as peas, beans, clover, etc.

PAPILIONACEOUS FLOWERS. A name given to the corolla of leguminous plants, as that of the garden pea and bean; it consists of a large upper petal, standard, or *vexillum;* two lateral petals, called *alæ,* wings; and two intermediate petals, forming the keel, or *carina.*

PAPILIONIDÆ. Lepidopterous insects, properly called butterflies, they feed by day.

PAPILLA, PAPILLÆ. Small delicate eminences, as on the tongue.

PAPPUS. The hairy down of thistles and other compositæ. Pappose is a derivative.

PAPS, or BARBS. (See Lampas.)

PAPYRUS. A large sedge (*Cyperus papyrus*). A native of the Nile and southern Asia, from which the ancients made their paper, or papyrus.

PARACENTESIS. Tapping, opening the covering of the abdomen, etc., to let out water.

PARACYANOGEN. A brown solid, with the composition of cyanogen.

PARADOX. An apparent absurdity, but really a fact.

PARAFFINE. A tasteless, inodorous, fatty matter, obtained, among the products of distillation, from wood tar.

PARAGUAY TEA. *Ilex Paraguayensis.* An evergreen holly, the leaves of which contain theine, and are used as tea in South America. (See Tea.)

PARALYSIS. Palsy. Paralytic is a derivative.

PARAPLEGIA. Paralysis of the upper or lower part of the body only.

PARASITE. Small insects or fungus growths on animals and plants, which live on the blood of the body, or the juices of plants. Their numbers are many, and species various. Among parasitic insects the flea, louse, mange insect, and itch insect are most annoying to animals. The principal species will be noticed under their appropriate names.

PARASITIC PLANTS. Plants which strike their roots into the textures of others, as the mistletoe; mildew, smut, rust, etc., are also parasites. Many insects are parasitical on animals.

PARASTATE. Square pillars standing from the wall.

PAREGORIC. Tincture of opium and camphor with oil of anise seed; an anodyne to allay pain.

PARELLA. *Lecanora parella.* A lichen of Europe, used as a dye, and similar to archil.

PARENCHYMA. The cellular substance of vegetables or animals.

PARGASITE. A kind of hornblende; sometimes crystallized, and of high value.

PARGET. A plaster of lime, hair, cow dung, and water sometimes used in coating the flue of a chimney.

PARHELION. The appearance of two or more suns from the misty state of the air. *Paraselenæ* are several moons seen from the same cause.

PARIETAL. In botany, any organ which grows from the sides of another is said to be parietal. The parietal bones, in zoology, are those at the sides of the skull, which together form the arch.

PARIS GREEN. Arsenite of copper, a deadly poison, used in the arts as color, and of late years extensively mixed with water, flour, gypsum, etc., as an insecticide for destroying the Colorado beetle and other noxious insects infesting vines and plants. The proportions are from one to two parts of Paris green to forty to fifty parts of the medium with which it is mixed.

PARK. An enclosed woodland pasture, or ornamental, wooded landscape.

PAROTID GLAND. A large salivary gland, situated at the angle of the jaws.

PAROXYSM. A sharp attack, an increase of sickness.

PARSLEY. *Petroselinum sativum.* A biennial plant, that will endure the winter in the West, if thickly covered with brush and litter just before freezing weather, but which is universally grown as an annual plant. It requires extra rich, mellow soil for the best results, and the curled varieties should be transplanted several times to get extra fine leaves for garnishing. Sow the seeds in a hot bed about the first of March. Transplant as soon as large enough, three inches apart. When nice plants are thus obtained, select the handsomest curled ones and transplant six inches apart, and again at a distance of twelve to sixteen inches apart each way. The other plants, to be used in soups, stews, etc., may be planted six inches apart by sixteen inches between rows, or the seed may be sown in drills half an inch deep, and sixteen inches apart, and the plants thinned to six inches in the row. In the autumn the roots may be taken up and kept in dry sand in the cellar, to be planted out the succeeding spring, or to be used for forcing in the hot bed. Dwarf curled parsley is one of the best for family use. The Hamburg parsley, is a variety with fusiform roots, and are eaten boiled. The cultivation is precisely like that of parsnips, carrots, etc., which see.

PARSNIP. *Pastinaca sativa.* A hardy biennial plant standing out during our coldest winters, and with advantage in flavor to the fusiform root, the edible portion of the plant. If allowed to stand, the second year the flower stalk is thrown up to the height of five or six feet, the seed ripening in July and August. The preparation of the soil and cultivation of all esculent fusiform roots is alike. The land requires deep plowing, heavy manuring, with compost, or if not with manure the year previous to planting, since recent green manure causes the roots to fork and become uncouth in shape. The rows should be two feet apart for ease in horse cultivation. About three pounds of seed is required per acre, and the plants are to be thinned to about three or four inches in the row, when of sufficient size to admit of it. The cultivation should be thorough enough to keep the rows friable and mellow, and the rows must be kept entirely free of weeds. In the autumn just before the ground freezes a sufficient quantity should be dug out for winter consumption, and packed in a bin with air-dry sand or road dust about them, the remainder of the crop may be left until spring and taken out as soon as the frost leaves the ground. For garden cultivation the rows may be eighteen inches apart, and the plants thinned to six inches. The best varieties of parsnips for garden cultivation, is the Guernsey and the Student. For field cultivation the hollow crowned is generally sown. Upon rich, deep, mellow soil, crops as high as fifty tons per acre have been taken. They are a most valuable winter food for cows and swine, and in some countries they are largely raised for this purpose. The only drawback is the expense of digging. This, however, may be much simplified by the use of two heavy curved coulters, of a peculiar shape, attached to a gang plow, and which is capable of loosening two rows at once, going over five acres a day so they may be easily drawn by hand.

PARTERRE. In gardening, a system of beds of different shapes and sizes, in which flowers are cultivated, with intervening spaces, paved, of gravel, or turf, for walking on.

PARTRIDGE. *Perdicidæ.* The partridge differs from the grouse in having the legs unfeathered below the knee, and in having the nostrils uncovered. In the New England States, most of the Middle States and generally in the West, this bird is known as Quail. In the South, it is known by its true name of partridge. In the New England States the Ruffed Grouse is called partridge, and in the Middle States, this bird is called pheasant. The true quail is not found in the United States. It is of the genus *coturnix*, the partridge subfamily, while the American family of so called quails belong to the subfamily *odontopharinæ*, and *ortyginæ*, and of the genus, *ortyx*, *oreortyx*, *lophortyx*, *callipepla*, and *lyrtonyx*. The partridge of the North and most of the South, is well known by its familiar cry, resembling Bob White, and hence often so called. The female makes her nest of grass, circular in form, and places it at the foot of some tuft of grass, or amid the cornstalks, laying from ten to twenty pure white eggs, sharp at the smaller end. These are so nicely arranged within the nest, that should they be taken out it would be found impossible to return them as they previously were. The male often assists in hatching these, and always remains in the vicinity, cheering his mate by uttering his love-note from some favorite perch. When the young are ready to leave the shell, a circular opening is made by the mother through which they are issued into the world. The shell that covers this spot remains unbroken, and is attached to the remaining portion by a small fragment which allows it to open and shut like a door upon its hinges; and a deserted partridge's nest, if it has escaped injury, is a curiosity well worth preserving, containing, as it would, a number of these shells, with their movable lids. The young run as soon as they are hatched, and remain with their parents until the following spring, when they separate for the purpose of reproduction. They always roost at night upon the ground, arranged in the form of a circle, with their bodies nearly touching, and if alarmed, each individual takes a direct and separate course. The food of all the species is the seeds of weeds and grain, but during the season of their activity their principal food is insects, of which they destroy vast numbers of many noxious species, with the greatest pertinacity. They are one of the most valuable of insectivorous birds. Yet notwithstanding their usefulness, they have been so ruthlessly destroyed, as to have become almost extinct in the older States. As a rule the birds remain in a given locality winter and summer, yet sometimes they become partially migratory, suddenly leaving one neighborhood and as suddenly appearing in another. Nevertheless, the bird is not capable of long flights, as is its European relative. Although a hardy bird, yet it frequently succumbs to our severe winters, and multitudes of them are found frozen to death. When disturbed the whole flock rise at once, with a loud whirring of the wings, very trying to the nerves of the young sportsman, and fly with much rapidity, generally in a direct course, and after alighting scatter and lie very close, enabling their pursuer to flush them one at a time, and frequently in this way the entire covey is destroyed. As an article of food this bird is in much demand, being generally very plump, and its flesh white, tender, and juicy. The male has the forehead, line over the eye, and throat white, sides of head and band below the throat black; the rest of the head and neck reddish brown; back and wings chestnut, lower portion of the former tinged with yellow; tail grayish blue, the middle feathers grayish yellow, mottled with black; sides of the neck spotted with white; under parts white, streaked on the sides with red, and transversely barred with black; under tail coverts red; bill black; feet grayish. The female resembles the male, excepting the head, which has more reddish yellow, and also the throat is yellow instead of white. An allied species, characterized as the Texan partridge, (*Ortyx Texensis,*) is found in Texas. It is a smaller bird than our common species, but closely resembles it in plumage; a casual observer, indeed, would not detect much difference between them. I am not aware that they are very unlike in their habits, and the foregoing account will very likely answer for both. The next, a very handsome species, and equally valuable as an article of food, is the Plumed partridge, (*Oreortyx pictus,*) a native of the mountain ranges of California and Oregon. It goes in rather small coveys, sometimes of not more than eight or ten, excepting from October to March, when, according to Douglas, it congregates in vast flocks, and seems to live in a state of almost perpetual warfare, and is found principally among the dense woods that border the Columbia river and its tributaries. The male has the forepart of the body plumbeous, the upper parts yellowish brown, sometimes slightly shaded with red; the forehead is ash color, rest of head lead color; a crest of two long straight feathers spring from the center of the head of a black color; the throat is bright chestnut, with a black margin, followed by a white band passing downwards from the eye; the middle of the breast is bright chestnut, the feathers on the flanks possessing margins of black and white bands succeeding each other; tail brown, the under coverts black, streaked with orange chestnut; bill black; feet yellow. The female is similar, but less brightly colored. The feathers of the crest are much shorter, while the center of the back, the wings, and tail are faintly crossed with dusky lines. The next genus contains two very handsome species, the first of which is the California partridge, (*Lophortyx Californicus,*) an inhabitant, as its name implies, of California, where it is found upon the plains and lowlands, sometimes assembling in flocks to the number of two or three hundred, and are generally fat and well flavored. It takes the place there of our brave little bird of the eastern coast which is never found so far to the westward. It appears to be confined to the plains, rarely or never, I believe, found in the mountainous districts, where it is replaced by the preceding species. I have had them in captivity, but like all of this family they were very restless, seeking all the time for some avenue of escape. The male has the forehead straw color, behind which is a white band, which passes back along the sides of the crown, in the center of which anteriorly is a narrow line of the same color; back of head light brown; crest velvet black, commencing in a fine point, increases in width toward the end, and curls forward sometimes over the bill; chin and throat black, with a white line coming from the eye; back and sides of neck blue gray, bordered with black, and a small spot of white at the end of each feather; rest of upper parts olive brown; tail gray; forepart of breast blue; abdomen buff, with a large chestnut spot in the center. each feather margined with black in the form of a crescent; flanks brown, with a whitish line in the center, and a broad one of buff on the outer webs; under tail coverts buff, with a central stripe of whitish. Female wants the black and white marking of the head; has the throat brownish yellow, streaked with brown, and without the orange spot on the abdomen; the crest is short; bill black; feet gray. The second species, equally distinguished for its beauty of plumage, is the Gambel's partridge, (*Lophortyx Gambelii,*) named in honor of its discoverer. It is an inhabitant of the upper Rio Grande and Gila rivers to the Colorado of California. In the male the forehead is white, each feather having a narrow line of black, with a transverse white band succeeding; top of head reddish chestnut, crest brownish black, throat black, margined with white. The upper part of the body is bluish ash, flanks chestnut, each feather having a longitudinal stripe of white; middle of the breast and abdomen white, with a large black spot on the latter; bill black; feet brown. The female has the throat whitish, with the head plain ash color, without the conspicuous markings of the male, and also destitute of the black on the belly. The crest is short and of fewer feathers. The next genus has but one species, not as handsome as the preceding, and is known as the Scaly Partridge, (*Callipepla squamata*). This bird is also an inhabitant of the Rio Grande of Texas, and although not so beautiful in plumage as either of the two last species, yet is a very pretty bird. It is noted for its extreme swiftness in running, and depends as much upon this power for eluding pursuit as upon its wings, rarely using the latter even in open ground. It prefers the vicinity of water courses, and is wild and exceedingly watchful, rarely approaching the settlements. This species is generally very plump, its flesh white and of a delicate flavor, and is much esteemed for food. It has a beautiful crest, which can be laid flat upon the head, although it is frequently spread out like a fan. The head is light ash color, the crest broadly margined with white. General color bluish-ash, growing paler on the under parts, and nearly white on the abdomen, with the feathers of the under parts edged with black; flanks have a central stripe of white on each feather, and frequently there is a large chestnut spot of a pale hue on the abdomen; under tail coverts almost white, striped with brown; bill black; feet brownish. The sexes are nearly alike, the female, perhaps, not being quite so deeply colored, and the crest not so full. The last member of this family, to be included in this article, is a very singular looking, yet beautiful bird, and is known as the Massena partridge, (*Cyrtonyx Massena*). The fantastic arrangement of opposing colors upon the head of the male creates a very curious and striking effect, so much so as to cause Mr. Gould, the eminent English ornithologist, to exclaim that it forcibly reminds one of the painted face of the clown in a pantomime. It is a native of Texas and Mexico, met with chiefly in the former region, on the upper Rio Grande and the high plains of the Pecon. This species, I believe, generally goes in small covies, and is gentle and affectionate in its disposition, evincing but little fear of man's presence when he invades their domains, thus showing exactly the opposite trait of character from the scaly partridge, which is at all times wild and suspicious. The male had the forepart and sides of the head white, with a black stripe beginning at the base of the bill, and running above and below the eye, the lower portion widening into a gular patch, which joins a broad black mark on the throat. A black line in the center of the head, commencing at the bill, and changing to brownish on the upper part of the head. Crest buff yellow, upper parts light chestnut, every feather transversely barred with black, and having a central streak of yellowish-white. The black bars are broader on the wings, sometimes forming nearly circular spots. A wide stripe of deep chestnut runs down the center of the breast and abdomen; the flanks deep black, each feather with several circular spots of pure white; thighs and under tail coverts deep black. Tail and upper coverts same color as the wings. Bill dark brown, feet paler brown. The female is very different. Head and upper parts of the body are reddish-brown, each feather barred with black and streaked with yellowish-white. Under parts cinnamon, with central stripes, and also one on each side the shaft, of black. The head is entirely without the conspicuous markings of the male. The throat is pale white, and the flanks have regular lines and small spots of black.

PARTURITION. On the farm, among animals which have good shelter and plenty of food, but little difficulty is experienced in bringing forth the young. The exceptions are generally when mechanical difficulty is present, as in rigidity of the womb, or else contracted pelvis bones. Other difficulties are the unnatural presentation or position of the young. These are, a reverse presentation, or the tail first; the fore feet protruding without the head; the head protruding without the fore feet, or with only one; the fore feet appearing, with the head turned under the brisket; with the belly upward, the head turned over the shoulder, the fore legs first; or, with the fore legs folded against the back of the dam, the head, side, or hind leg presenting first. All violence should be carefully avoided until it becomes absolutely necessary, a case that seldom happens. The first thing to be done is to put the fœtus in proper position, with the fore feet first, the head between the feet, and the back upwards. This may generally be accomplished by having the cow standing with her hind feet considerably higher than the fore feet. Then a small hand and arm, well oiled to the elbow, introduced into the womb, the difficulty may generally be obviated. The calf being in position, and delivery difficult, introduce both hands, the palms together, to grasp with the tips of the fingers the head behind the ears. When the labor pain comes on, press strongly, at the same time pulling forward, and the fœtus generally follows one or more attempts. If there is rigidity of the mouth of the womb, a knife should be introduced (narrow and blunt at the point), held in the hollow of the hand. Fix the mouth of the womb with the fore finger, slip the blade of the knife along the fingers, until the mouth of the womb is reached, and inside, about a quarter of an inch, make a slight cut or nick on four sides of the neck thereof. This will allow expansion, and generally allow delivery. Except in very urgent cases, a little extract of belladonna, rubbed about and inside the neck of the womb will sufficiently relax. In very rare instances with the cow, the neck of the womb may have become twisted. This being the case, to be suspected in long continued labor without presentation of the bag enclosing the water, the hand should be carried well into the orifice, so as to push the bag in the opposite direction to the twist, while assistants roll the cow quickly over on the other side. Repeat this until the presentation of the womb is natural. In rare cases, the orifice is so small, or the calf so large that considerable violence must be used even with a natural presentation. In this case a hook is to be inserted in the socket of the eye of the calf and a steady pull maintained, in connection with the labor pains, and finally in still more extreme cases, the calf may have to be dissected piecemeal within the walls of the womb; this any careful person with a firm hand may accomplish, if he has previously studied the anatomy of the animal. Generally all that will be necessary will be to dislocate the shoulders and perhaps the head. In all such cases, however, the dam should be fattened, or if a mare prevented from further breeding. In case of flooding, bleeding from the womb, if the flow is free a sponge dipped in hot vinegar and water, or hot water alone, or very cold water, should be introduced and wrung out in the womb. Give also one or two ounces, as the case may be, of ergot of rye at once. If the bleeding is internal, shown by paleness of the nose, weak pulse, great debility and general coldness of the skin, introduce the hand, clean away the clots of blood from the womb and especially any adherent portions of the afterbirth, and proceed as before directed. If these do not act promptly introduce a piece of ice the size of a small hen's egg into the womb, or dissolve a teaspoonful of powdered alum in a teaspoonful of milk, and squeeze a tablespoonful into the womb. To the mare or cow may also be given two tablespoonfuls every two hours in a quart of water, of the following: three ounces compound tincture of cinnamon, and five ounces of dilute sulphuric acid.

PASSERINES, PASSERES. Birds similar to the sparrow, including those which neither manifest the violence of birds of prey, nor have the fixed regimen of the terrestrial birds, but which feed on insects, fruit, or grain, according to the slenderness or strength of their beak; some with sharp and toothed mandibles, pursue and feed on small birds. All the passerines have short and slender legs, with three toes before and one behind, the two external toes being united by a very short membrane. They form the most extensive and varied order of birds, and are the least readily recognizable by distinctive characters common to the whole group. The passerines, in general, have the females smaller and less brilliant in their plumage than the males; they always live in pairs, build in trees, and display the greatest art in the construction of their nests. The young are excluded in a blind and naked state, and wholly depend for subsistence, during a certain period, on parental care. The brain arrives in this order at its greatest proportional size; the organ of voice here attains its utmost complexity; and all the characteristics of the bird, as power of flight, melody of voice, and beauty of plumage, are enjoyed in the highest perfection by one or other of the groups of this extensive and varied order.

PASSIONFLOWER. The genus *Passiflora*, bearing beautiful flowers, and, in some species, tolerable fruit, and a good wood resembling ebony.

PASTEL. A dye stuff, resembling indigo, from the plant *Isatis tinctoria.*

PASTERN OF A HORSE. The distance that intervenes between the joint of that name and the coronet of the hoof.

PASTURAGE. The value of pasturage is second to no other product of the country. Yet it is the fact that comparatively few permanent pastures are to be found in the country. This is undoubtedly owing to the fact, that but comparatively a small portion of the United States is so broken and hilly as not to be susceptible of easy cultivation. Hence our pasture grasses are such as are used for hay. Timothy and clover are the two principal plants used for hay. Clover is a biennial, or, at most a triennial, and hence except when it constantly re-seeds itself, it s soon lost. Timothy, on account of its bulbous oot at the surface of the ground, is not adapted o close pasturage. Hence for permanent pasure, we must seek for those grasses forming a lose, compact sod, and which, at the same time, re perennial and not easily killed by the trampng of stock. In the article clover, in that of grass, and in writing of individual species, we have noticed many varieties not in general cultivation here. In the question of grasses for pasturage, therefore, experiment must be made as to the adaptability of certain species. This will be treated of further on. Those grasses that do well generally, and which are well known in all the grass growing sections are red and white clover, timothy, red top, blue grass, and orchard grass. If our agricultural colleges in each State would make careful and long-continued experiment with various grasses, both for hay and pasturage, with a view of ascertaining their adaptability to various soils and climates, their power of withstanding summer droughts and tramping, then it would be of incalculable benefit to the agriculture of the several States in a direct money point of view, and greatly assist farmers in determining their respective values. Until this is done systematically and in concert by the management of the several State schools, the farmer must depend upon his own experiments. (See article Grasses, for specific distinction of grasses.) It is evident that the main dependence for pastures must be those plants that do well generally. Among the clovers will be found red clover, white or Dutch clover, and Alsike clover; the two last given will do well on rather moist land. Alsike clover (*Trifolium hybridum*) is a pale-red perennial species, and on moist lands may undoubtedly be cultivated with advantage, either for pasture or mowing. It makes fine pasturage, better, we think, than white clover; and fair hay, but not so valuable as that from red clover. As a pasturage for bees, it is also most valuable. It loves a clayey soil, especially a marly clay, and thrives on marshy lands, even when sometimes overflowed. It has the disadvantage of not springing into growth after being mown for hay, and also that it requires two or three years to become well established in the soil. In general appearance and habit of growth is intermediate between the common red and white clover. It is highly valuable for pasturage, growing rapidly after being eaten down, and furnishing a large amount of food during the season. The stems remain soft and succulent even when old, never becoming so woody and hard as that of red clover; it also partakes of the creeping, spreading habit of white clover. It yields well when cut for hay, being thick and close, although not so tall in growth as the red clover. Red clover succeeds well in all soils not strongly inclined to heave. In fact, in all well drained soils. White clover succeeds well in dry soils, and also in moist ones, if not wet. Alsike grows in soils moister. From their general adaptation to the West, they should be given a trial everywhere. These three varieties of clover are all that may be considered, except on the dry soils far west, where alfalfa is found valuable. Our advice in seeding either for pasture or meadow is to seed freely for pasture of all three varieties, and for meadow with red clover on dry soils, and with Alsike on moist soils. Of the three grasses for pasturage, where it will stand, the chief reliance may be upon blue grass, red top, orchard grass, fowl meadow, sheep fescue. Late experiments in Wisconsin with fowl meadow grass (*Poa Serotina*) sometimes called false red top, have shown this to be a most valuable grass both for the meadow and pasture. It will undoubtedly be found so in many localities. Hence the necessity of experiment with other varieties. In relation to the nature of the pasturage and the grasses to be sown for special grazing, all farmers know that horses and sheep bite close to the ground and that cattle do not. Hence for cattle long pasturage is necessary; also that cattle, horses, and sheep leave particular varieties to grow up to seed, unless starved, while others they pasture close. In our dry, summer climate, pasture often becomes brown in summer, sometimes for long periods. At such time soiling crops, or grain, or both, should be provided, if in one's power. To accomplish this the soil should be rather compact as to its lower portion, but smooth and with a firm mellow tilth as to its surface or seed-bed. In seeding for a permanent pasture anywhere, whatever the mixture of grasses may be, not less than thirty pounds per acre of grass seed should be sown, and many of our best graziers advise forty pounds of seed per acre. The basis of our pastures must consist of red clover, white clover and Alsike clover, and the fine grasses named. Blue grass, however, is so persistent that it will soon root out the other grasses on soils congenial to it, and also the clovers, except white clover. As the basis for experiment, we give a list that has been found valuable in England, and regret that there has been no accurate test experiments carried out as yet in the United States to show the value of many of the varieties, that will be named from first to last, to test their capabilities in their power of withstanding drought and our more severe northern winters. It must be recollected that the climate of Great Britain is cool and moist, and mild in winter, while ours is hot. The varieties are as in the following lots:

FOR SPRING, ELEVEN SPECIES.

1. Alopecurus pratensis.
2. Dactylis glomerata.
3. Festuca pratensis.
4. Phleum pratense.
5. Anthoxanthum odoratum.
6. Arrhenatherum avenaceum.
7. Lolium perenne.
8. Bromus arvensis.
9. Poa annua.
10. Avena pratensis.
11. Vicia sepium.

FOR SUMMER AND EARLY AUTUMN, ELEVEN GRASSES OR CLOVERS.

1. Avena flavescens.
2. Hordeum pratense.
3. Cynosurus cristatus.
4. Festuca duriuscula.
5. Poa trivialis.
6. Poa pratensis.
7. Holcus lanatus.
8. Trifolium pratense.
9. Trifolium repens.
10. Lathyrus pratensis.
11. Festuca glabra.

FOR AUTUMN, FOUR SPECIES.

1. Agrostis stolonifera.
2. Achillea millefolium.
3. Agrostis palustris.
4. Triticum repens.

In lot one we should throw out numbers 9 and 11. It is hardly probable that the annual poa, or that the vetches will be valuable. The same may be said of lot two, number 10. The Latherus or pea tribe are valuable for fattening, but would hardly stand in a pasture. The same may be said of number 2, in lot three, the Yarrow, or Milfoil. The probability is the list may have to be narrowed still more. Permanent pastures are not made in a single year. They take time, and once they have become permanent, they should be kept so by every means in one's power. Do not pasture too young, and never when so soft that it will poach. Give the sod time to form hard and solid, and you will have a permanent mine of wealth. The object of thick seeding is not only that one plant may support and nurse another, and thus quickly shade the soil, but also that every square inch of soil will surely contain seed. Sixty-four varieties of plants have been found in a single square foot of old English pasture, and from twenty to thirty is not unusual. The improvement of stock commenced in England, and has kept even pace there with the introduction of cultivated grasses and other forage plants. The four quarters of the earth have been examined for whatever might be found. Herein American farmers may take a valuable lesson, not only in experimenting with new grasses, and in the preparation of the soil, and in the quantity of seed sown, but in the great variety sown for pasture as well. The quantity of seeds sown per acre, at the rate we have indicated, will be something enormous when we recollect their extreme minuteness; but then it must be remembered that the finer the seed the more are lost from not germinating, and by killing before fairly established in the soil. It is poor policy to grudge seed in sowing a meadow, and especially a pasture. The following table will show the common and scientific name of some well known clovers and other plants, and the number of seeds per ounce:

Names of Plants.	Average number of seeds in one ounce.
Darnel, (*Lolium italicum*)	27,000
Orchard grass, (*Dactylis glomerata*).........	40,000
Red clover, (*Trifolium pratense*)............	16,000
Perennial clover, (*Trifolium pratense.. perenne*)	16,000
Foxtail grass, (*Alopecurus pratensis*)........	76,000
Fescue, (*Festuca pratensis*)................	26,000
Fescue grass, (*Festuca duriuscula*)...........	39,000
Meadow grass, (*Poa nemoralis sempervirens*)	133,000
Lotus corniculatus	28,000
Common Yarrow or Milfoil, (*Achillea millefolium*).....	200,000
Common Darnel, or Rye grass, (*Lolium perenne*)	14,850
White clover, (*Trifolium repens*)...........	32,000

Below we give lists of varieties that in England have been found to do well on various soils, with the quantities to be sown. In experimenting with these and other grasses, we would advise that each species be sown on some trial patches separately, noting their adaptability, season and growth. With this held in view, the following varieties and quantities will be found interesting, remembering that when trial patches of single varieties are sown that the rate of one pound to twenty-five feet square will be sufficient seed for an experimental plot.

LIST ONE. FOR A SANDY SOIL.

Names of Plants.	Pounds.
Timothy, (*Phleum pratense*)	2
Red top, (*Agrostis vulgaris*)	6
Velvet grass, (*Holcus lanatus*)	4
Rough Meadow grass, (*Poa trivialis*)....	6
White clover, (*Trifolium repens*)..............	12
Lucerne, (*Medicago maculata*)...	3
Running Vine, (*Lathyrus pratense*)..........	3
Per acre..................................	36

LIST TWO. FOR SANDY SOIL WITH A SLIGHT MIXTURE OF CLAY.

Names of Plant.	Pounds.
Phleum pratense......................... ...	2
Poa trivialis.........	6
Festuca elatior................................	6
Lolium perenne..............................	4
Avena pubescens............................	3
Vicia sepium.................................	2
Lotus corniculatus..........................	2
Trifolium pratense..........................	10
Per acre	36

LIST THREE. FOR CALCAREOUS SOILS.

Names of Plants.	Pounds.
Meadow Brome, (*Bromus pratensis*)	5
Orchard grass, (*Dactylis glomerata*)	4
Variety of Oat grass, (*Avena elatior*)	4
Rye grass, (*Lolium perenne*)	2
Rough Meadow grass, (*Poa trivialis*)	9
Kentucky Blue grass, (*Poa pratensis*)	2
Poa angustifolia	2
Lucerne, (*Medicago maculata*)	2
Red clover, (*Trifolium pratense*)	6
Italian clover, (*Trifolium fragiferum*)	4
Per acre	40

LIST FOUR. FOR STIFF CLAYEY SOILS.

Names of Plants.	Pounds.
Timothy, (*Phleum pratense*)	2
Foxtail, (*Alopecurus pratense*)	4
Rough Meadow grass, (*Poa trivialis*)	9
Meadow Fescue, (*Festuca pratensis*)	4
Festuca elatior	3
Fowl Meadow, (*Poa serotina*)	3
Lucerne, (*Medicago maculata*)	2
Red clover, (*Trifolium pratense*)	10
Wild Pea, (*Lathyrus pratensis*)	2
Vetch, (*Vicia sepium*)	2
Per acre	41

The time of flowering of the following grasses in England, their height, and soil adapted thereto, has been prepared, by which the time of flowering of any one of the species, (*Dactylis*, Orchard grass for instance) being known in any locality, that of the others may be very nearly computed. The table is as follows:

Names of Plants.	Time of Flowering	Height.	Lands best adapted.
Muhlenbergia.	August.	2 to 3 ft.	Low grounds.
Dactylis glomerata	June.	2 to 3 ft.	Meadow and pasture
Poa annua	Apr. Nov.	3 to 8 in.	Cultivated.
Poa serotina	June.	2 to 3 ft.	Moist land.
Poa trivialis	July.	1 to 3 ft.	Meadow and pasture
Poa pratensis	May, July.	1 to 2 ft.	Pasture.
Poa compressa	June, Aug.	9 to 18 in.	Pasture.
Anthoxanthum odoratum	May.	12 to 18 in.	Meadow and pasture
Festuca elatior	June.	3 to 5 ft.	Moist land.
Agrostis alba	July.	1 to 2 ft.	Moist land.
Muhlenbergia mexicana	August.	2 to 3 ft.	Moist land.

PASTURE THISTLE. (See Thistle.)

PATELLA. The knee pan.

PATENS, PATENT. Spreading.

PATHOGNOMIC. Symptoms which are characteristic of a disease.

PATHOLOGY. A dissertation on the effects of disease on the body.

PAVILION. In architecture, a projecting apartment on the flank of a building, usually higher than the rest of it. Summer-houses in gardens are sometimes, but improperly, termed pavilions.

PEA. *Pisum.* The cultivated pea is one of the most important of the pulse family, ranking next the bean, (*Phaseolus,*) in value. In Canada and the extreme northern portions of the United States where it escapes the ravages of the pea weavil, which further south stings the young pods, depositing its eggs therein, and hatching, the young find their way to the peas, which they burrow, avoiding the germ, but entirely ruining the seeds for food. When the crop escapes the ravages of this pest the crop is valuable and large quantities are exported. The chick pea, (*Cicer,*) has long been known in gardens and in India it has been known and cultivated as food for horses since the earliest historical times. So also the cow pea of the South, but which is really a bean, or a species of *dolichos*, of which asparagus bean is one of the cultivated varieties. The cow pea is considered one of the most valuable plants in the South for fodder, for its ripe seeds, for cattle, swine and horses, and also as a manurial crop for turning under green. It will thrive on land too poor for clover, and leaves the soil in admirable condition for an after crop. When sown among corn it affords valuable pasturage after the corn is ripe. Care, however must be taken that stock is not allowed to eat too freely of it at first, since like green clover it sometimes kills them from hoven or bloat, that is from the gas generating from the fermenting mass in the crowded stomach. The pea is cultivated all over the civilized world, in gardens, for eating green, or at the time the seeds are fully formed but yet not ripe. There are two distinct classes, the dwarf and the running. The dwarfs are sown about two feet apart between rows by half an inch in the rows, and need no brush. Among the best varieties are Tom Thumb, Little Gem and Yorkshire Hero, the latter a large, wrinkled pea of great excellence of flavor. If Tom Thumb or Little Gem are planted at the same time they will furnish a succession, Yorkshire Hero coming in about the time the others fail. For the general crop, however, the taller kinds are planted. Among the best varieties of these sorts for family use, are Daniel O'Rourke, Early, Champion of England, Medium, and Missouri Marrow, a late pea. The first named require brush about three feet high, although they are often left without brushing. Indeed market gardeners seldom brush them. Champions and Marrows require brush fully five feet high. In the kitchen garden it will pay to brush all the running varieties; Daniel O'Rourke should be sown in drills, early in the spring, three and a half feet apart, Champion five feet apart and Missouri Marrow six feet apart. If sowings are made later, the seed should be covered four or even five inches deep, since it is found that this deep planting assists the plants in withstanding drought. When the peas are to be brushed to support their growth, and all varieties that grow over two and a-half feet high are better for brushing, it is usual to sow in double rows—rather thinly—the double rows to be twelve to fourteen inches apart.

PEACH. *Persica vulgaris.* The original country of the peach is not certainly known. It is, however, indigenous to Persia, and was taken from thence to Italy by the Romans, in the time of the Emperor Claudius. Hence its name Persica, from Persia. In China it seems to have been cultivated from time immemorial, and their traditions in relation to the peach are not essentially dissimilar to our biblical account of the tree of knowledge, as generally understood.

Number.	NAMES.	DESCRIPTION.							I.—			
		Size.	Class.	Color.	Quality.	Glands.	Season.	Origin.	Nova Scotia.	New Brunswick.	Maine.	New Hampshire.
1	Allen's October						L.	Am.				
2	Alexander	m.	F.	w.	s. j.	g.	V. E.	Am.				
3	Alexandra Noblesse	l.	F.	w.	m.j.v.	g.	M.	F.				
4	Amelia	l.	F.	w.	m.j.r.	r.	E.	Am.				
5	Amsden's June	m.	F.	w.	a. j.	g.	V. E.	Am.				
6	Austin's Late Red	l.	C.	w.	j. v.	r.	L.	Am.				
7	Baldwin's Late	l.	F.	w.	j. m.	r.	L.	Am.				
8	Barnard	m.	F.	y.	j. v.	g.	E.					
9	Beer's Smock	l.	F.	y.	j. v.		L.	Am.				
10	Bellegarde	l.	F.	g.	s. j.	g.	M.	F.				
11	Bergen's Yellow	m.	F.	y.	j. v.	r.	M.	Am.				
12	Bordeaux	l.	C.	y.	j.	r.	E.	Am.				
13	Briggs' May	m.	F.	w.	m.		V. E.	Am.				
14	Catharine	l.	C.	y. g.	j. r.	r.	M.	Am.				
15	Chinese Cling	l	C.	g.	j. v.	r.	M.					
16	Cole's Early Red	m.	F.	w.	m.j.r.	g.	V. E.	Am.				
17	Columbia	l.	F.	y.	j. v.	r.	M.	Am				
18	Con's Cling											
19	Coolidge's Favorite	l.	F.	w.	s. j. h.	g.	M.	Am.				
20	Cook's Late White	m	F.	w.	m.j.v.		L.	Am.				
21	Counts	l.	C.	w.	m. j.		M.	Am.				
22	Crawford's Early	l.	F.	y.	j. v.	g.	M.	Am.				
23	Crawford's Late	l.	F.	y.	j. v.	g.	L.	Am.				
24	Crockett's Late White	m.	F.	w.	a.	r.	L.	Am.				
25	Deming's Orange (Deming's Sept.)	l.	C.	y. v.	j. r.		L.	Am.				
26	Druid Hill	l.	F.	g.	m.j.r.	g.	V. L.	Am.				
27	Duff Yellow	l.	C.	y.	m. j.	g.	E.	Am.				
28	Early Albert	m.	F.	w.	m j.v.	r.	E.	F.				
29	Early Admirable	l.	F.	w.	m. j.	g.	M.	F.				
30	Early Beatrice	s.	F.	w.	m. j.	r.	V. E.	Eng.				
31	Early Grosse Mignonne	m.	F.	w.	m.j.v.	g.	E.	F.				
32	Early Louise	m.	F.	w.	m. j.	r.	E.	Eng.				
33	Early Newington Free	l.	F.	g.	j. v.	g.	E.	Am.				
34	Early Rivers	l.	F.	p. y.	m. r.	r.	E.	Eng.				
35	Early Tillotson	m.	F.	g.	m j.r.	s.	V. E.	Am.				
36	Early York	m.	F.	w.	m.j.r.	s.	V. E.	Am.				
37	Eaton's Golden	m.	C.	y.	a. j.	r.	L.	Am.				
38	Flewellen	l.	C.	y.	j. r.		E.	Am.				
39	Foster	l.	F.	y.	j. v.	g.	L.	Am.				
40	George the Fourth	m.	F.	y.	m.j.r.	g.	M.	Am.				
41	Grosse Mignonne (Royal Kensington).	l.	F.	w.	a. j. h.	g.	M.	F.				
42	Haines' Early Red	m.	F.	g.	a. j.	g.	V E.	Am.				
43	Hale's Early	m.	F.	w.	m.j.r.	g.	V. E.	Am.				
44	Harker's Seedling	l.	F.	y.	a. j.	g.	M.	Am.				
45	Heath Cling	l.	C.	g.	a. j. h.	r.	V. L.	Am.				
46	Hill's Chili	m.	F.					Am.				
47	Honeywell	m.	F.	w.	a. j.		E.	Am.				
48	Hoover's Late Heath											
49	Hyslop Cling	l.	C.	w.	m.j.r	r.	V. L.	Am.				
50	Indian Blood Cling	l.	C.	y.	j. v.	r.	L.	Am.				
51	Indian Blood Freestone	l.	F.					Am.				
52	Incomparable	l.	C.	w.	m. j.	r.	L.	Am.				
53	Jacques	l.	F.	y.	j. v.	r.	M.	Am.				
54	Kenrick's Heath (Heath Freestone).	l.	F.	g.	j. v.	r.	L.	Am.				
55	Keyport White	l.	F.	w. r.	m. j.	r.	V. L.	Am.				
56	Lady Parham	m.	F.	g.	j. v.	r.	V. L.	Am.				
57	La Grange	l.	F.	w.	a. j. h.	r.	V. L.	Am.				
58	Large Early York	m.	F.	w.	a. j. h.	g.	V. E.	Am.				
59	Large White Cling	l.	C.	w.	a. j.	g.	L.	Am.				
60	Late Red Rareripe	l.	F.	w.	a. j. h.	g.	M.	Am.				
61	Late Admirable	v. l.	F.	y. g.	m. h.	g.	M.	F.				
62	Lemon Cling	l.	C.	y.	j. v.	r.	L.	Am.				
63	Leopold I. (Leopold Freestone).	l.	F.	y.	j. v.	r.	M.	F.				
64	Malta	l.	F.	g.	m.j.r.	s.	M.	F.				
65	Mammoth Freestone	v. l.	F.									
66	Mitchell's Mammoth	l.	C.	g. w.	m. j.		L.	Am.				
67	Molden's White	l.	F.	w.	a. j.	r.	L.	Am.				
68	Montgomery's Late	l.	F.	w. r.	m. j.	r.	L.	Am.				
69	Morris White	m.	F.	w.	m.j.r.	r.	M.	Am.				
70	Mountain Rose	m.	F.	w.	a. j.	g.	M.	Am.				
71	Noblesse	l.	F.	w.	a. j.	s.	M.	F.				

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4 This originated in South Carolina, and differs from the Missouri Amelia.

15 Berckmans thinks it is same as Shanghae.

25 Resembles Lemon Cling.

	NORTHERN DIVISION. Between 42° and 49°.															II.—CENTRAL DIVISION. Between 35° and 42°.																				III.—SOUTH. DIVISION. Between 28° and 35°.										
Number.	Vermont.	Massachusetts.	Rhode Island.	Connecticut.	New York.	Ontario.	Michigan.	Wisconsin.	Minnesota.	Dakota.	Montana	Wyoming.	Idaho.	Washington.	Oregon.	Pennsylvania.	New Jersey.	Delaware.	Maryland & D. C.	Virginia.	North Carolina.	Ohio.	Indiana.	West Virginia.	Kentucky.	Tennessee	Illinois.	Iowa.	Missouri.	Nebraska.	Kansas.	Colorado.	Utah.	Nevada.	California.	South Carolina.	Georgia.	Alabama.	Florida.	Indian Territory.	Arkansas.	Mississippi.	Louisiana.	Texas.	New Mexico.	Arizona.
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66 Resembles Heath Cling, but later.

Number.	NAMES.	DESCRIPTION.							I.—			
		Size.	Class.	Color.	Quality.	Glands.	Season.	Origin.	Nova Scotia.	New Brunswick.	Maine	New Hampshire.
72	Old Mixon Free	l.	F.	g.	s. j. h.	g.	M.	Am.				
73	Old Mixon Cling	l.	C.	w.	m. j. r.	g.	M.	Am.				
74	Pavie de Pompone	l.	C.	w.	m. j.	r.	L.	F.				
75	Petite Imperial	l.	F.	w.	m. j. v.	r.	L.	Am.				
76	Picquett's Late	l.	F.	y.	s. j.	r.	M.	Am.				
77	President	l.	F.	w.	m. j. r.	g.	M	Am.				
78	Prince of Wales	l.	F.	w.	m. j.	r.	M.	F.				
79	Princess of Wales	l.	F.	w.	m. j. v.	g.	M.	F.				
80	Pucelle de Malines	l.	F.	w. r.	m. j.	s.	M.	Am.				
81	Raymond Cling	l.	C.									
82	Red Cheek Melocoton	l.	F.	y.	j. v.	g.	M.	Am.				
83	Reeves' Favorite	l.	F.	y. r.	m. j.	g.	M.	Am.				
84	Richmond	m.	F.	w.	m. j.	r.	M.	Am.				
85	Rodman's Cling	l.	C.	w.	j. v.	r.	L.	Am.				
86	Royal George	m.	F.	w.	m. j. r.	s.	E.	F.				
87	Salway	l.	F.	y. r.	m. j.	r.	M.	Am.				
88	Scott's October	m.	C.	y.			V. L.					
89	Shockley's Early											
90	Smock	l.	F.	y.	j. v.	r.	L.	Am.				
91	Snow	m.	F.	w.	s. j.	r.	M.	Am				
92	Snow's Orange	m.	F.	y.	m. j.	r.	M.	Am.				
93	Stump the World	l.	F	w.	s. j. h.	g.	L.	Am.				
94	Sturtevant	m.	F.	y.	s. j. h.	g.	M.	Am.				
95	Strawberry	m.	F.	w.	m. j.	r.	M.	Am.				
96	Susquehanna	l.	F.	y.	s. j. v.	g.	M.	Am.				
97	Tippecanoe	l.	C.	y.	j. v.	r.	L.	Am.				
98	Troth's Early	m	F.	w.	s. j.	g.	E.	Am.				
99	Tuskena Cling											
100	Van Zandt's Superb	m.	F.	w.	m. j. r	g.	M.	Am.				
101	Ward's Late Free	l.	F.	w.	r. j. s.	r.	L.	Am.				
102	Washington Cling	m.	C.	y. r	m. j.	r.	L.	Am.				
103	Wheeler's Early	s.	F.	w. r.	m. j.		V. E.	Am.				
104	White Imperial	m.	F.	w.	m. j. r.	g.	E.	Am.				
105	Yellow Alberge	m.	F.	y.	s. j.	g.	E.	F.				
106	Yellow Rareripe	l.	F.	y.	j. v.	g.	E.	Am.				
107	Yellow St. John (Fleita's or Flater's St. John.)	l.	F.	y.	s. j.	g.	V. E.	Am.				

The peach began to be generally cultivated in England about the middle of the sixteenth century, and was brought from hence to America about 1680. In England, peaches can not be raised without the protection of a wall, the trees being trained along the south side. Even in France their cultivation is not entirely successful without the aid of protection, except in the southern portions. China and the United States are the only temperate climates where the peach arrives at full perfection. In Michigan, the northern line of cultivation is Grand Traverse bay, near the foot of lake Michigan. West of lake Michigan they can not be grown north of central Illinois and southern Iowa. Yet if it were not for winter killing, the summers would ripen them up to the latitude of St. Paul, Minn. There are none of our fruit trees so easily propagated as the peach. If the stones are placed in a thick layer in a shallow trench, in the autumn, and covered with eight inches of earth, and then planted in April, they will be ready for budding in September. This should be done quite near the ground. The following spring the top should be cut back near the bud. The growth will often reach six feet the first season, and the third year they will bear. In the North they are sometimes budded on the plum, since this stock is hardier than the peach, and the trees are dwarfed thereby. Budded upon the Mirabelle plum stock they become quite dwarf, and thus are suitable for orchard houses. The soil best adapted to the peach is a rich, deep, dry, sandy loam; but they grow well on a strong, mellow loam, or even in light sand. In fact, any dry, good soil, except a heavy clay, does well for the peach. On very light soils the trees are quite subject to the yellows. (See Yellows in Peach.) So severe has this disease become within the last few years in Michigan, that most stringent laws have been passed for its eradication. In some otherwise good peach growing districts, the blossoms are killed by late spring frosts. Where this is the case, the trees should be planted on northern slopes, or on high, airy situations, or along the banks of deep streams, lakes, or bluffs. The most noted peach region in the West is the Michigan lake shore region, in Michigan; next, the bluffs about Alton, Ill., and then the whole timbered region south of Centralia. South of the Ohio river, and in Missouri and Kansas, and south, the peach is everywhere at home. The peach orchard should have good cultivation early in the season, and the pruning should consist simply in shortening in the branches, to keep the head as dense as possible. The peach is so easily grown that it seems strange that Western farmers should not plant them more for home use. They will, with care, bear two or three years in five, up to the northern limits of Illinois, and when

	NORTHERN DIVISION. Between 42° and 49°.															II.—CENTRAL DIVISION. Between 35° and 42°.																				III.—SOUTH. DIVISION. Between 28° and 35°.										
Number.	Vermont.	Massachusetts.	Rhode Island.	Connecticut.	New York.	Ontario.	Michigan.	Wisconsin.	Minnesota.	Dakota.	Montana	Wyoming.	Idaho.	Washington.	Oregon.	Pennsylvania.	New Jersey.	Delaware.	Maryland & D. C.	Virginia.	North Carolina.	Ohio.	Indiana.	West Virginia.	Kentucky.	Tennessee.	Illinois.	Iowa.	Missouri.	Nebraska.	Kansas.	Colorado.	Utah.	Nevada.	California.	South Carolina.	Georgia.	Alabama.	Florida.	Indian Territory.	Arkansas.	Mississippi.	Louisiana.	Texas.	New Mexico.	Arizona.
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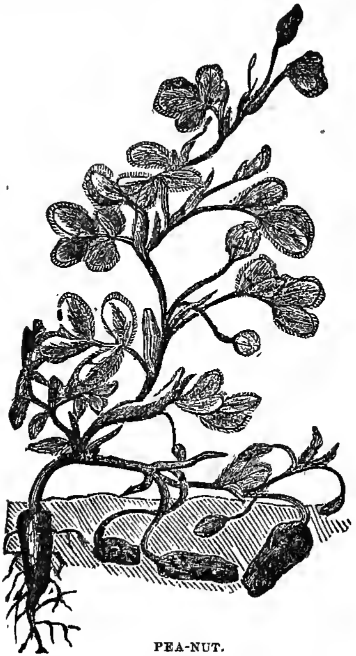
the trees are winter killed they may be easily renewed. We have seen finer peaches nowhere than used to be grown on the sandy soils in protected situations near Chicago. Above we give the list of varieties supposed to be adapted to various sections of the United States, as lately revised by the American Pomological Society, in which will be found varieties adapted to any climate where the peach will flourish.

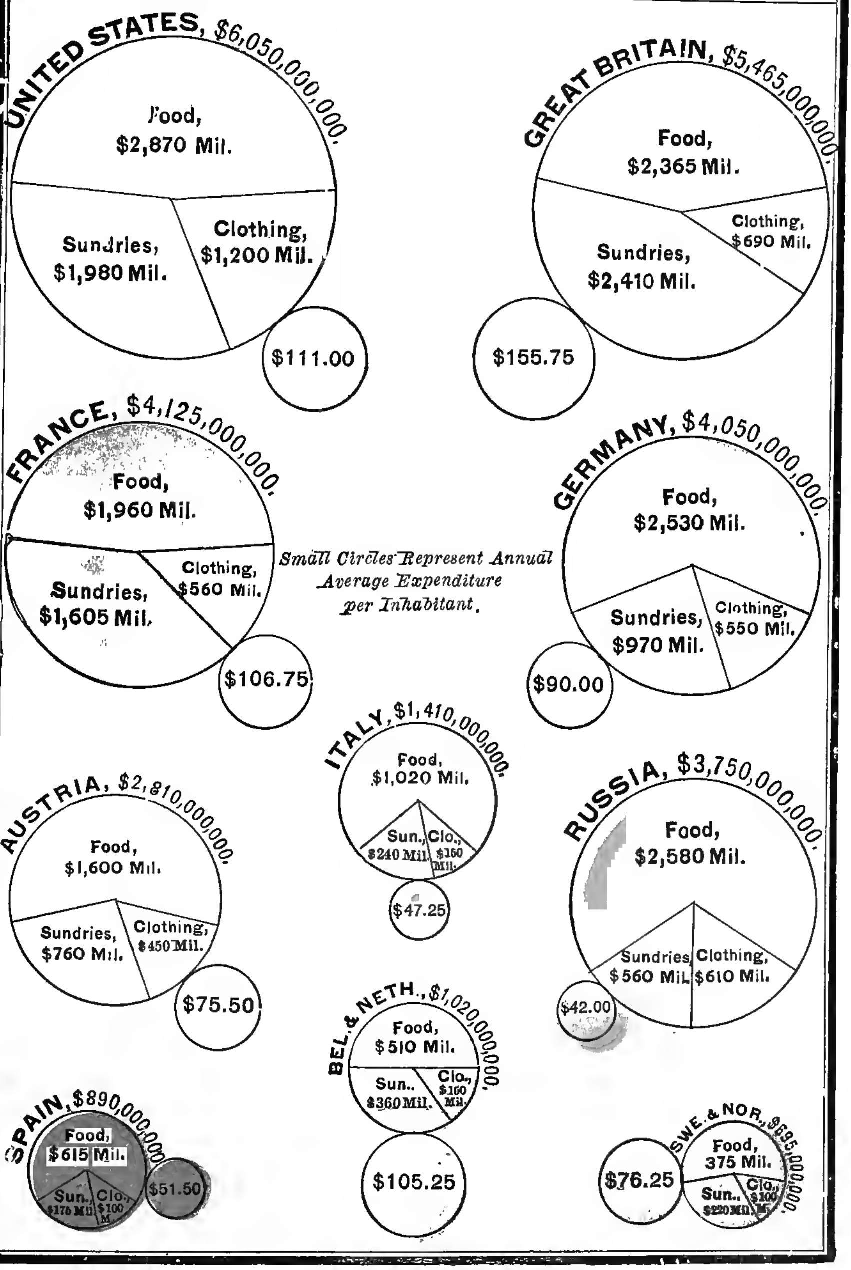
The columns explain: Size—l , large; m., medium; s., small. Class—F., freestone; C., Clingstone. Color—relative to the flesh, w , white or pale colored; y., yellow or yellowish; g., greenish white, red at stone. Quality—j. v., juicy, vinous; m. j. r., melting, juicy, rich; s. j.. sweet and juicy; s. j. h., sweet, juicy and high flavored. Glands—s., serrated, without glands; g., glands globose; r., glands reniform, Season—the season of maturity, as Early, medium or Late, those designated as Early, ripen in lat. 43° previous to or about Sept. 1; Medium; those ripening from 1st to 15th Sept., and Late those after that period; a few of the Very Early and Very Late are so designated—E., early; M, medium; L., late; V. E., very early; V. L., very late. Origin—Am. American; F., Foreign. *, signifies doing well; * *, great superiority and value; †, new and recently introduced for trial.

PEA-NUT. Goober, Pindar, Ground Pea, Ground Nut. *Arachis hypogœa.* In Tennessee and down the Mississippi, it is known by the name of Goober, and on the Atlantie coast as Ground-pea; commercially, however, the word pea-nut is the usual term. It is a native of India, but is now extensively raised in Virginia and North Carolina, and in Kentucky and Tennessee and Southern Illinois. Those raised in the sandy soils of the Atlantic coast are the best. A peculiarity of the pea-nut is that when the plant flowers, the young seed pod enters the soil where the seed ripens, as is shown in the cut. The seed is sometimes planted all over the surface at a distance of a foot apart each way, and if not earthed up, the vines will yield a ton of dry fodder per acre, considered fully as good as clover. The usual way of cultivation is to plant in drills three feet apart, one nut in a place, at a distance of twelve inches apart. The earth is kept free of weeds and at the time of blossoming the drills are bedded up so as to make a mellow surface for the young nuts to strike in. When ripe, the vines are pulled and dried, without getting wet, the peas whipped off, cleaned up in a common fanning mill and sacked for market. The produce varies from sixty to ninety bushels and even more per acre. The seed produces a most excellent oil, superior to olive oil for salads. As an illuminating oil it is excellent, burning with a clear flame and pleasant fragrance. The seed produces from forty to fifty per cent. of oil, and the nuts are largely used in the adulteration of chocolate, and especially in chocolate preparations of confectionery. The following is from a practical cultivator in Virginia: Any soil that can be put in a friable condition, and kept in that state, will produce peanuts; but that which is best adapted to their growth is a light, gray soil, without being very sandy. The color of the pods always partakes of the color of the soil; and as the brightest pods always bring the most money, so the gray land is to be preferred. When harvested they are perfectly clean, scarcely a particle of soil adhering to them. Not so with red or chocolate-colored lands. They leave a stain on the pods, of which they can not be divested even by washing—a practice frequently resorted to for the purpose of getting a fancy article. When taken to market the bright nuts will command from ten to fifteen cents more per bushel than the brown, though equal in all other respects. The gray soil is therefore to be selected when there is freedom of choice, but the brown soil, when of the right texture, is equally productive. In choosing a site for planting, reference should be had to the crop of the previous year. Peanuts require a clean soil; they will follow any hoed crop to advantage, with the exception perhaps of sweet potatoes. Corn land is generally preferred. In tide-water Virginia much of the land was heavily marled in former years, and whenever this is the case an important and perhaps the chief requisite to success has been already provided. The peanut will not fruit except on a calcareous soil. The vines may grow with the greatest luxuriance, covering the whole ground, but in the absence of lime or marl the pods do not fill; they turn out to be nothing more than what is popularly called pops. If, then, the land has not been previously marled or limed, it will be necessary to apply say a hundred and fifty bushels of marl or fifty bushels of lime, to the acre. The kind of lime chiefly used of late years is burned oyster shells, which may be had in abundance in all the large towns. It is applied in either of several ways, according to the convenience of the planter, and with about equally good effect. If there is any choice, spreading broadcast is perhaps the best, to be done before the land is plowed; in which case the quantity should be about fifty bushels to the acre. A favorite mode, where a large surface is to be planted, is to strew the lime in the furrow over which the bed is to be raised for planting. In this case a less quantity will answer, by reason of its being more concentrated—say twenty bushels. Other planters, again, who are hurried in their work, spread the lime over the beds after the crop is planted, at the rate of about thirty bushels to the acre. Either mode is attended with good success; but wherever it is practicable to have a choice of land that has been sufficiently marled or limed in former years, and preserved by judicious culture, the best results are found to follow. In such cases the yield not unfrequently reaches a hundred bushels to the acre. The product ranges from the quantity stated down to twenty-five or thirty bushels to the acre, according to the skill, or want of skill, of the planter—a fair average of the whole being estimated at fifty bushels. Few persons make peanuts part of a regular system of rotation, but the pre-eminent success of a gentleman who has followed the plan is worthy of special reference. The lot intended for peanuts, say next year, has been seeded in stock peas this year, the vines to be plowed in sometime in September. The vines afford a great quantity of vegetable matter, which becomes thoroughly decomposed by the time for planting the crop. When the season for planting is at hand, the ground is replowed and laid off, and ten bushels of lime and a hundred and fifty to a hundred and seventy-five pounds of superphosphate strewn in the furrows to be ridged over. The year following peanuts the land is planted in sweet potatoes, with a liberal dressing of stable manure. The third year it is laid down in stock peas again, to be followed by peanuts as before, always repeating the lime and superphosphate. Having selected the ground, it is to be plowed with a one-horse plow in March or April to a depth not exceeding four or five inches. The advantages of shallow culture will be apparent from the fact that the peduncles continue to penetrate the earth until a firm bed is reached on which to deposit the nut; and the still further fact of the increased facility afforded in harvesting as will appear when we come to treat of that branch of the subject. About the 10th to the 20th of May is the time for planting. If the land is thin and needs manuring, open furrows three feet apart, and strew in a hundred to a hundred and twenty-five pounds of Peruvian guano, or from a hundred and fifty to two hundred pounds of superphosphate of lime. The former is generally used, because of the greater certainty of getting a pure article, but nothing can be better than the latter when well prepared. The furrow is then to be ridged over and the whole surface thrown into three-feet beds, which should be reduced to within two or three inches of the general level of the field. Then mark off the rows, and at distances of


PEA-NUT.

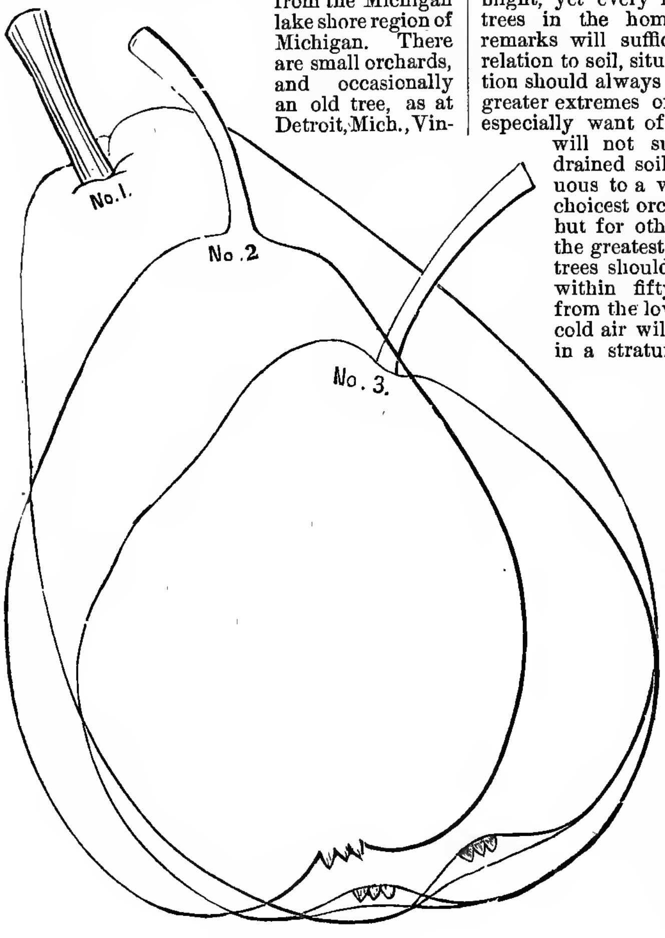
COST OF LIVING IN VARIOUS COUNTRIES.

Annual Expenditure per Individual.



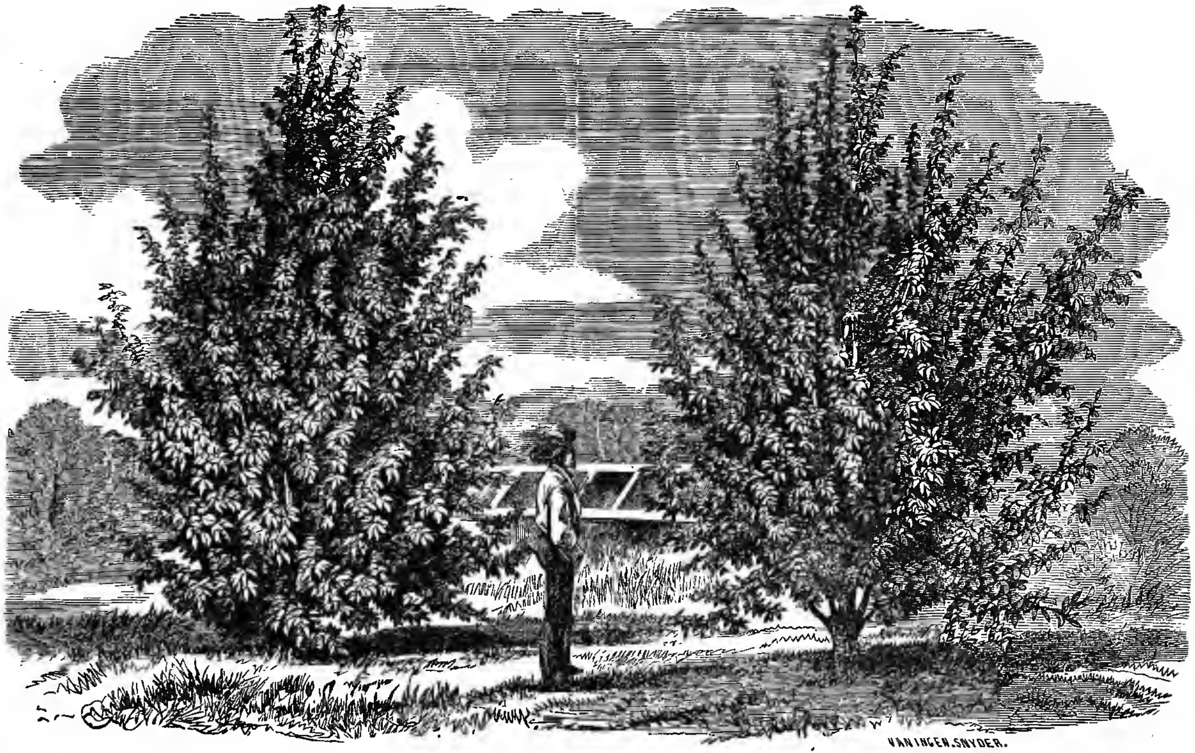
eighteen inches plant two seeds, covering them an inch to an inch and a half deep—not more. In ten days or two weeks according to the weather, the young plants begin to come up. As it is very important to get a good start, the missing hills should be replanted at the earliest moment. It is the custom of some planters to put an extra quantity of seed in every fourth or fifth row, to furnish plants for transplanting, if needed; if not needed, they can be thinned out. As soon as the grass makes its appearance give a light plowing, throwing the earth from the vines, and following with the hoe, thoroughly removing all the grass from the row. Plow again as soon as the grass reappears, this time using a double shovel or cultivator, and the hoe as before directed. If the season should prove to be very wet, a third working may be necessary, making use of the cultivator and hoe again. Next comes the time for laying by, the vines having extended nearly half way across the space between the rows. This is done by running a mold-board once in the middle between the rows, and drawing the earth up to the rows with a hoe, care being taken not to cover the vines and to disturb their position as little as possible, as the fruit will now be forming. It will be necessary also to guard against making the bed too high. When there is grass in the row it must be pulled up by hand. Soon after this the vines will cover the whole ground, and repress every other growth, unless it may be a chance weed that escaped notice at the former working. The time for harvesting the crop is from the 15th to the 30th of October, immediately after the first frost. When the crop is forward, or when it is an object to get a portion of it early in market, the operation may be commenced in the latter part of September; but the longer the vines continue to grow, the greater will be the number of sound pods. Select a time when the weather is settled and favorable, and with three pronged hoes loosen the vines along the rows. Hands follow the digger, pull up the vines, shake the dirt from them, and leave them in the same place. In dry weather they will be sufficiently cured in two days to be shocked. Showery weather, though it may somewhat delay the curing, does no injury. One of the advantages of shallow culture becomes apparent in harvesting. When the fruit is deposited only a few inches below the surface, the vine is detached from its position with little or no loss; when the depth is greater, the stems or pedicels are liable to be broken off. In shocking, provide stakes seven feet long, made sharp at both ends; then lay two fence rails on the ground as a foundation, but with supports underneath to afford free access to the air. The stakes are stuck in the ground at convenient intervals between the rails, the stacks built up around them, and finished off by a cap of straw to shed the rain. The diameter of the stack is made to conform to the spread of a single vine. After remaining about two weeks in the stack the picking should be begun, taking off none but the matured pods. These are to be carried to the barn, and prepared for market by finishing the drying process, and then fanning and cleaning. The most tedious part of the work is the picking. An expert discriminates at a glance between the mature and immature pods, but can not pick more than two and a half or three bushels per day. A machine to perform the operation would be a most valuable invention. Unless the management in the barn is carefully conducted, there is great danger, where there is much of a bulk, that the peas will become heated and moldy. The condition in which the early deliveries are often received at market renders this caution quite necessary. In fact, there is as much slovenliness in the handling of this crop as there is in regard to any other; perhaps more, for the reason that so many inexperienced persons engage in the culture every year. Until the pods are thoroughly seasoned, the bulk should be frequently stirred and turned over. A certain classification, in respect to quality, obtains in peanuts as in every other article of agricultural produce. The descriptive terms in general use are inferior, ordinary, prime, and fancy; but these are not so definite as to admit of no intermediate grades. Assuming prime to be the standard, and that the prime are $2.75 per bushel, then inferior will be worth, say $1.00 to $1.50; ordinary, $2.00 to $2.50; and fancy, $3.00. Seed peanuts always command an extra price; ranging from $3.25 to $3.50. There are two very distinct varieties of peanuts, known respectively by the names of the Virginia, and the Carolina or African. The diversity between them, however, does not amount to a specific difference, the chief characteristic being that the one has a large pod and bean, and the other a small one. The Virginia is cultivated almost exclusively for eating, while the Carolina is principally used for the manufacture of oil, which can not be distinguished from olive oil, and is, accordingly, sold as such. The standard weight of the Virginia peanut is twenty-two pounds to the bushel; that of the Carolina twenty-eight pounds. In the markets they are always sold by weight. A matter of primary importance is to provide seeds of good quality for planting; and in order to be assured of their excellence, the planter should either raise them himself, or buy them of a person on whose fidelity he can rely. If, after the vines are dug and they are lying in the field, they should be exposed to frosty weather, the germinating principle would be destroyed or impaired. As a merchantable article, however, their value is not affected. Neither should the nuts become the least heated or moldy; nor should they be picked off the vines while wet, or before they are thoroughly cured. It is obvious, therefore, that the most careful attention is requisite in this matter. Previous to planting, the pods should be carefully shelled and every faulty bean thrown out; not even the membrane inclosing the seed should be ruptured. It takes about two bushels of peanuts in the pod to plant an acre.

PEAR. *Pyrus communis.* The pear would undoubtedly be the favorite dessert fruit of the day, were it not, that, owing to the blight and other disabilities neither uniform crops, nor the life of the tree itself can be depended on even in the most favored localities in the United States. The delicious varieties of the present day leave little to be desired as a fruit to be eaten out of the hand Pears are older than history, and yet it is only within the last 150 years that the exquisite qualities of this fruit have been developed, and only within the last fifty years that it has really been brought to perfection. This indeed may be said of the apple, the plum, the cherry and the peach, and yet not to the same degree. Although Belgium has been called the Eden of the pear, yet neither there nor elsewhere has a fruit been produced that will equal our Seckel, a chance seedling found in a hedge row in Pennsylvania, yet the average citizen will pass it by on our fruit stalls. They want big pears, and they get them, while the wise take the little russet red Seckel, and laugh in their sleeves. California is now the most famous pear growing district in the United States. In the vicinity of Boston, they do fairly well. Large quantities are sent from the Michigan lake shore region of Michigan. There are small orchards, and occasionally an old tree, as at Detroit, Mich., Vincennes, Ill., and near Indianapolis, Ind. We wish we could advise the general planting of pear orchards. We can not. Nevertheless every farm orchard should have a small collection of pears. Among the varieties of good pears that succeed measurably well in various parts of the country are: 1. Bartlett; 2. Belle Lucrative; 3. Beurre d'Anjou; 4. Duchesse d'Angouleme; 5. Flemish Beauty; 6. Howell; 7. Lawrence; 8. Onondaga; 9. Seckel; 10. Sheldon; 11. Winter nelis. 1, 3, 4, 5, 6, 7, 9 and 11, are favorites in the West. Winter nelis, however, wants age to make it productive. The outline cut given above will show the forms of pears from obovate to oblong-ovate-pyriform. No. 1 being a representation of Pitmaston Duchess; 2. Duhamel du Morceau, and 3. Hoosic. The pear is peculiar in its growth, as a rule, inclining to pyramidal in the form of the tree, though they vary considerably. The cuts on page 716 represent two dwarf trees which will explain themselves. So on page 717 we give an illustration of the Howell pear showing the form and distinctive markings of the fruit, and also a branch and leaf. While we can not advise the planting of pear orchards except in peculiar soils and localities, subject to blight, yet every farm should have some pear trees in the home orchard. The following remarks will sufficiently cover the ground in relation to soil, situation and care: A low situation should always be avoided, on account of the greater extremes of temperature, humidity and especially want of deep drainage, for the pear will not succeed except on a deeply drained soil. A sloping hillside, contiguous to a well defined valley, forms the choicest orchard site, not only for pears, but for other fruits as well. To insure the greatest advantage from position the trees should not be planted lower than within fifty feet of upright elevation from the lowest point in the valley. The cold air will then settle during the night in a stratum below the trees, and the warm air accumulated in the lower ground during the day will be pressed up to the higher altitude occupied by the orchard, and thus afford considerable protection in cold nights The obvious necessity of shelter to pear orchards has led, in some instances, to the mistake of selecting low grounds for their apparently well-protected position, which, for the reasons given above, are the worst possible localities. Contrasted with valley planting, even what might be termed bleak exposures have the preference, and the unsatisfactory results attending orchards in low protected grounds has led to a supposition that shelter is injurious rather than beneficial. The addition of shelter to an otherwise judiciously selected site is quite different from endeavoring to secure it by choosing a low situation. The efficacy of protection is now generally well understood, especially by those who attempt pear culture in regions that are comparatively treeless. Even the White Doyenne, the famed Virgalieu, or butter pear, worthless in exposed situations, is produced in all its pristine excellence, where the tree is protected, as may be seen in many old gardens in cities, where this variety is still common. The shelter required is not so much to repel or alleviate mere thermometric cold, as it is to arrest evaporation and its accompanying exhaustion of vitality, by checking the rapid and penetrating action of dry winds. Evergreen trees afford the most perfect shelter in the least

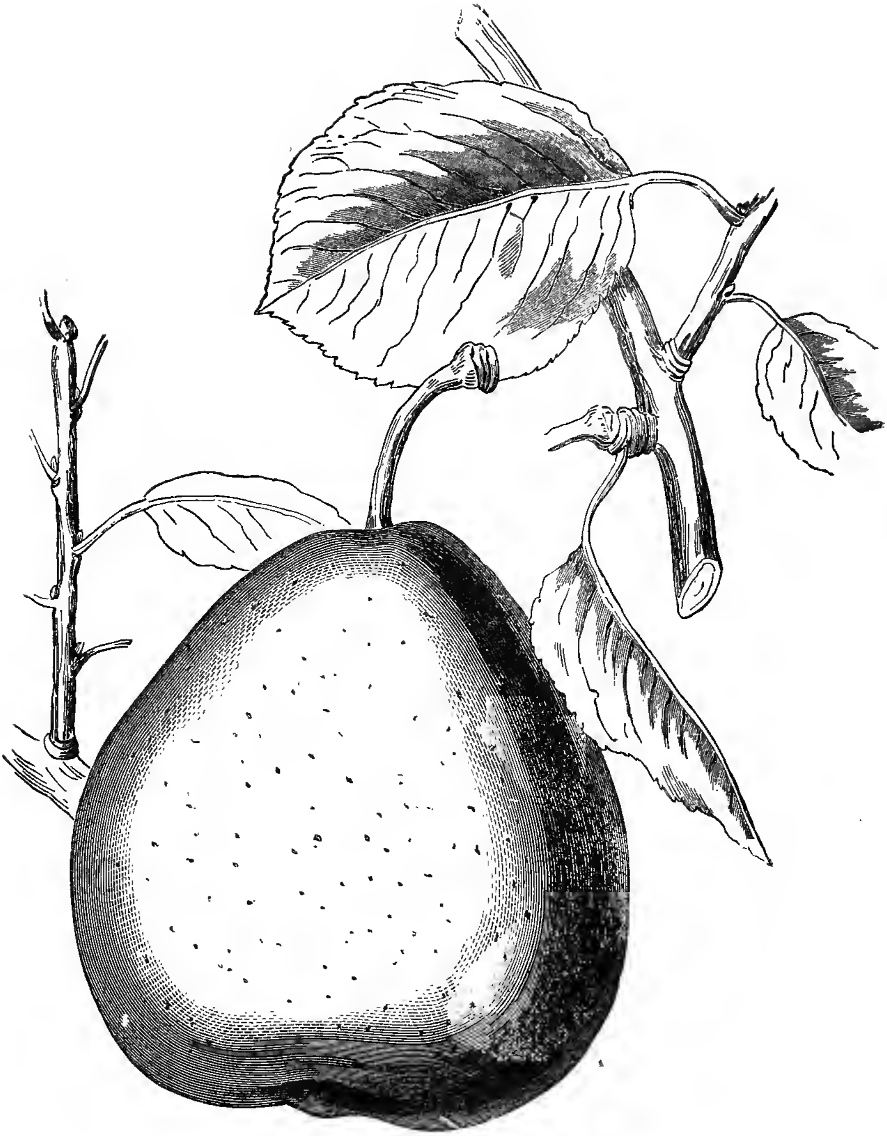


OUTLINE OF PEARS.

space. A single row of Norway firs, Austrian pines, or other equally hardy evergreen trees will give shelter for a considerable distance; thickly planted belts of deciduous trees will also render effective service. How far apart these belts and hedges should be placed, and in what direction they will be most useful, will depend upon the surroundings and local specialities. As the best mode of draining a field will depend upon its surface undulations, so the best mode of sheltering will be guided by the general aspect and position of the orchard. The pear will exist in a variety of soils, but attains greater perfection in clayey loam. Even on stiff clays the tree will grow and produce very satisfactorily under the ameliorating influences of the preparation and culture which such soils require. Draining first and subsoiling afterwards are the chief requisites for gradual amelioration; in short, while a water-soaked clay soil is the most utterly worthless of all lands for the growth of any crop, a properly drained and aerated clay soil is by far the most valuable, and only requires careful management to render it available for the best productions of the orchard, farm, or garden. The prominent precaution in managing a clay soil is never to work on it while wet, but only when it is dry to friability. No expedient or process of culture will compensate for the injury sustained by working clay soils during summer, when they are saturated with water; the injury can not be remedied except by a winter's freezing, which will again produce friability under proper treatment. Soils of a sandy or gravelly character are not well adapted to the pear. In these soils, so variable in their degree of moisture, the trees ripen prematurely and drop their foliage early, if the weather proves dry toward the end of summer; then, in the event of moist weather following a period of drought, a late secondary growth will be produced, which, failing to mature, induces a tendency to blight, and predisposes to other diseases. Surface dressings of compost, repeated cultivation, or constant mulching, will counteract to some extent, the effects of uncongenial soil for the pear roots, but where it is impracticable to select any but a thin gravel or sand for the growth of this fruit, the dwarf tree is preferable, as the roots of the quince can be confined to a small area, which may be prepared and maintained to meet all requirements of growth. Where the soil has been prepared by deep tillage it will not be necessary to dig holes deeper than required to merely cover the roots of the plant. In heavy soils that have not been prepared in the most thorough manner the holes should be made wide rather than deep. In gravelly subsoils pits may be dug eighteen inches in depth, the surface soil and subsoil being thrown out at opposite sides, and filled in equally until the proper height is reached for setting the plant. In either case about a bushel of compost made up of leaf mold, rotted manure, and light soil if carefully spread around the roots, will form an admirable rooting medium; this should be finely pulverized and rather dry than wet when used. Deep planting and shallow planting are the injurious extremes in setting trees. The plain and incontrovertible rule is to set the plant so that the point from whence the stem and roots proceed in opposite directions will be about one inch below the level of the surface of the ground. It is infinitely better to plant so that some future surface dressing may be required to cover the swelling exposed roots, than to have them buried below the ready influence of atmospheric heat and air. The preservation of a proper degree of moisture in the soil surrounding the roots of the tree is the principal object of culture during the first summer after planting. Both the kind and amount of care will depend upon the nature of the soil and the condition of the weather; something will also depend upon the first preparation of the ground. Where the soil has been drained, deepened, and pulverized, and the surface is loose and mellow, nothing further will be required than merely to prevent a growth of weeds. If the surface is tenacious, frequent stirring, especially after rains, will probably suffice, but where the soil is shallow and largely composed of sand or gravel, mulching will most effectually accomplish the purpose. Any loose material will answer as a mulch, such as coarse manure, strawy litter of any kind, or short grass as cut from lawns; where a few trees only are to be cared for, tan bark and refuse charcoal dust are frequently employed. Mulch should not be applied before the middle of June, unless the weather proves very dry and warm previous to that time, and on clean ground it may remain during the following winter, or be renewed if exhausted; but in rough soddy ground, where field mice may lurk, the soil around the trees should be fine and kept clean and compressed. The best mode of treating the soil in pear orchards is an important question both in regard to the health of the tree, and the production of fruit. Laying aside all special circumstances, it appears evident that the condition of the plants will indicate the treatment required; the object being to maintain health and encourage fruitfulness, and the measure of successful accomplishment of these conditions will greatly depend upon the knowledge of the principles governing vegetable growth possessed by the cultivator. When the trees are young the chief object is to encourage judicious growth, by employing expedients known to favor vegetable extension, such as the application of manures, breaking up and pulverizing the soil, surface stirring, and other similar operations. By judicious growth is meant a luxuriance not incompatible with maturity, and as this will depend upon climate and locality, it is evident that a discriminating knowledge of cause and effect will largely influence success. In northern latitudes where the season of growth is confined to five months' duration, it will be impossible to mature the same amount of wood that can be produced on trees in a locality having seven months of growing season. In the latter case stimulating appliances may be used with the best effects that would only tend to dissolution in the climate of short summers. The great desideratum in fruit culture is ripened wood; all useful cultivation begins and ends with this single object in view, and is the criterion of good or bad management. To cultivate, or not to cultivate, is a question to be determined by climate and condition of soil. Where it is deemed advisable to encourage growth, it will be proper to employ such appliances of culture as are known to produce that result; and again, when ample luxuriance is secured, and the tendency is still in that direction, all surface culture should be abandoned, and the orchard be laid down in grass, cultivation


VAN INGEN.SNYDER.

DWARF PEAR TREES.



HOWELL PEAR

to be again practiced when the trees indicate its necessity. The pear tree is usually a victim of excessive pruning. It is pruned in winter to make it grow, and pruned and pinched in summer to make it fruit. Why is it that the pear, more than other spur-bearing fruit trees should be supposed to require so close and continued pruning does not appear of easy explanation. It is evident that this immoderate pruning is not followed by satisfactory results, for while apple, plum, and cherry trees fruit with abundant regularity, with but little attention to pruning, unfruitfulness in the pear is a frequent cause of complaint, especially with those who pay the strictest attention to pruning rules, showing clearly that successful pear culture is not dependent upon pruning alone. While it is perhaps equally erroneous to assert that pear trees should not be pruned at all—an extreme which no experienced cultivator will indorse—it is worthy of inquiry whether unpruned trees do not exhibit a better fruit-bearing record than those which have been subject to the highest pruning codes. How far the proverbial liability of the pear to suffer from blight may be due to the interference and disarrangement of growths caused by summer pruning it may not be possible to decide, but the tendency to late fall growths, and the consequent immaturity of wood which is thereby encouraged, is well known to be of much injury, and greatly conducive to disease. Perhaps no advice that has been given is so fruitful a cause of failure and disappointment in fruit culture as that embodied in the brief sentence, Prune in summer for fruit. The physiological principle upon which this advice is based is that which recognizes barrenness in fruit trees as the result of an undue amount of wood growth, and that, in accordance with acknowledged laws, any process that will secure a reduction of growth will induce fruitfulness. The removal of foliage from a tree in active growth will weaken its vitality, by causing a corresponding check to the extension of roots, but the removal of the mere points of strong shoots has no palpable effect in checking root growth, the roots proceed to grow, and the sap seeks outlets in other channels, forming new shoots, which in no way increase the fruitfulness of the plant. While it may be confidently stated that, as a practical rule, easily followed, and of general application, summer pruning for fruit can not be recommended except as an expedient rarely successful, it is also true that there are certain periods in the growth of a plant when the removal of a portion of the shoots would tend to increase the development of the remaining buds, without causing them to form shoots. For example, if the growing shoots of a pear tree are shortened or pruned by removing one-third of their length, say, toward the end of June, the check will immediately cause the remaining buds on these shoots to push into growth and produce a mass of twigs as far removed as may be from fruit-producing branches. Again, if this pruning is delayed until August, and the season subsequently proves to be warm and dry, the probabilities are that the remaining buds will develop into short spur-like shoots, from which blossom buds may in course of time be formed; but if the season continues wet, and mild and growing weather extends late into the fall, these same shoots will be lengthened into weakly, slender growths, which never mature, and are of no use whatever. There is no certainty as to the proper time to summer prune, because no two seasons are precisely alike, and trees vary in their vigor from year to year; and yet this uncertain, indefinite, and constantly experimental procedure is the basis upon which the advice to prune in summer for fruit is founded. The pear tree, in fact, requires very little pruning, and that only so far as may be necessary to regulate branches in either of two exigencies. In the first place, when the young tree is placed in its permanent position in the orchard, its roots will be greatly disturbed and many of them destroyed; it will therefore be expedient in this exigency to abridge the branches, so as to restore the balance of growth that existed between the roots and branches previous to removal. This pruning at transplanting has its opponents on the theoretical grounds that, as the formation of roots is dependent upon the action of leaves, it must follow that the more branches and leaves left upon a plant the more rapidly will new roots be produced; but there is one important element overlooked in this reasoning, namely, this loss of sap by evaporation, which speedily exhausts the plant, while it has no active roots to meet the demand. The proper practice is to reduce the branches so as to give the roots the preponderance, and many kinds of trees can only be successfully removed by cutting the stem off close to the ground. If the tree has been pruned close back at planting, the first summer will develop the foundation for a well-balanced, symmetrical plant, but as this result depends upon a good start, it is well to keep an eye on the young growths during the first season, and if any of the shoots appear to be developing to the detriment of others equally necessary for future branches, the points of such shoots should be pinched off, but in doing so, let there be as small a removal of foliage as possible, the object being not to weaken, but merely to equalize growth. It is claimed, as a general rule, that no advantage will be gained by pruning any portion of the shoots after the first season, unless in the case of weakly trees, which will be strengthened by pruning down during winter. The removal of branches during summer weakens growth, but when a portion of the branches are removed after growth is completed, the roots, not having been disturbed, will have the preponderance, and the number of buds being diminished, those that are left will receive increased vigor. It should never be forgotten that there is nothing more certain than that by shortening in or pruning back the ends of shoots, either in summer or winter, the fruit-producing period is retarded, and the fruit-producing capabilities of the trees abridged. Fruiting spurs will not form where the growths are constantly interrupted and excited by pruning; but, after the third or fourth year, young shoots will, in the majority of varieties, become covered with fruiting spurs the second year after their formation, if left to their natural mode and condition of growth. Of course this refers to trees in soils of moderate fertility, grown in a climate favorable to the plant. The only pruning, then, that is really essential, after the plant has become established, will be confined to thinning out crowded branches; and this forms the second exigency for pruning. If low-headed trees are preferred, those branches that have become destitute of fruiting spurs near the body of the tree may be cut out and a young shoot be allowed to take the place of the one removed. There will be no lack of young shoots for this purpose, as they will be produced from the base of the cut branch, selecting the strongest and best placed to occupy the vacancy, if such occupancy is desired. This mode of cutting back branches will be more particularly essential in the case of dwarf pears, as the quince roots are unable to support a tall, heavy-headed tree, but in all other respects dwarf pears should be treated the same as standards. In comparing remarks and observations made by different cultivators with reference to the merits of varieties, their growth, productiveness, size, and quality of fruit, and other characteristics, there is found so great a disparity as to lead to a supposition that different varieties are being discussed under the same name. No doubt this is occasionally the case, but the difference caused by the influence of the stocks upon which they are worked is frequently to blame for these discrepancies Every nurseryman is aware of the great irregularity of growth in plants of the same variety; they may have been grafted at the same time on stocks of equal size—planted on the same day and in the same soil, yet their comparative growths will vary considerably; so much difference exists that the plants will be classed into two or more sizes, and held at different valuations. Although the vigor of growth imparted is thus varied, the habit of the variety is not changed, the upright form of growth will still characterize the Buffum, and the spreading habit of the Rostiezer will remain with each individual of that variety; but in a plantation of fifty of any sort there will be some weak growers, and an occasional specimen that, after lingering on in a sickly condition for several years, will finally be removed. It is reasonable to expect these diversities in the growth of stocks produced from seed, and the influence they impart to the graft, but it is seldom that allowance is made for the many peculiarities that may undoubtedly be traced to this cause. This is still further confirmed by the more uniform growth of dwarf pears, the stocks of which are produced from cuttings or layers, and are consequently of more uniform vigor, being an extension of one individuality, instead of the separate individualities of seedling plants. The greatest drawback to extended pear culture is the disease familiarly known as blight. The predisposing cause of this malady has not been specifically determined; the active cause of dissolution is known to be parasitical fungi. This much, however, experience seems to confirm, that trees placed in positions and under circumstances of soil and climate that insure a growth of moderate vigor, which growth shall become perfectly matured and solidified before the advent of winter, are so seldom attacked by this disease as to be, for all practical purposes, exempt. A safe practice, and one that will probably become general when further and extended experiments prove its value, is to cover the body of the tree and all the principal branches, but not the buds, with a wash, formed by placing one peck of lime and two pounds of sulphur in a vessel, and adding sufficient boiling water to slake the lime. If the white color is objectionable it can be changed to any other more suitable. The spread of fungi on the bark of trees has been arrested by timely application of this mixture. The opinion is now becoming prevalent that close planting, so that the trees shelter each other, is advantageous. For standard trees, eighteen feet apart is considered a good maximum, and ten feet for dwarfs. These distances preclude the practicability of using horse-power in the culture of the soil, at all events after a few years' growth; which, all things being considered, may be regarded as a step in the right direction.

PEAT. A fibrous earth, the remains of the decomposition of aquatic grasses, in a transition state toward the formation of coal. Localities where found, are termed peat bogs, and when other fuel is scarce it is commonly used, burning with a clear flame or smouldering, according to its quality. It is cut, with a peculiarly shaped tool, in the form of large bricks, and after being thoroughly dried, is stored away for use. Peat is not common in the United States on account of the rarity of the peculiar swamps where it is found. In northern Indiana, and in some portions of Wisconsin, there are rather extensive bogs of peat, but the cheapness of other fuel renders its use unprofitable. Probably the abundance and cheapness of wood and coal in the United States has prevented the development of the resources of our peat bogs. Peat, according to various analyses, presents a general similarity in composition, the difference in quality being sand of accidental mixture. Air-dried peat usually contains from fifty to sixty per cent. of carbon, although the best samples reach seventy-five per cent. Thus from one and a quarter to one and a half tons of peat should be equal to a ton of good coal. The top of the best peat bog is always composed of a spongy mass, consisting of decaying vegetable matter, roots, etc.; deeper it becomes more and more homogeneous in its nature, until, at length, all trace of vegetable structure is lost, and we find a dense black mass of hard and compact peat, ranging in specific gravity when dried, from that of water to considerably less. That near the top of the bog may not have a specific gravity of more than 0.28, but some dense Irish peats have shown a specific gravity of 1,058. In curing peat it is essential that it be thoroughly dried, since if moist, it will generate heat, and undergo spontaneous combustion. The same fact is observed in some of our soft coals that become air-slaked, and thus take fire.

PECK. A dry measure of two gallons; a quarter of a bushel.

PECORA. The *Ruminantia.*

PECTIN. The jelly of fruits, roots, and plants; it is soluble, transparent, insipid, and much like gum. Pectic acid is very similar, isomeric, and bibasic; the salts are called pectates.

PECTINATE. Divided so as to resemble the teeth of a comb.

PECTORAL. Relating to the chest.

PEDATE. Resembling the foot of a bird.

PEDICEL. The foot stalk of the flower, not of the bunch of flowers, which is the peduncle.

PEDIMENT. The triangular ornament over a building, door, window, etc.; it is often sculptured, and seldom exceeds in height two-ninths of its width.

PEDIPALPS. Spiders and other arachnidans, with the feelers in the shape of claws.

PEDUNCLE. The main flower stem.

PELLICLE. A delicate covering, film, or membrane.

PELLITORY OF SPAIN. *Anthemis pyrethrum.* A perennial herbaceous composite, the root of which is very pungent, and is chewed for toothache. It is very similar to chamomile.

PELTA. A shield; the seed shield of some lichens. A peltate leaf is shield-shaped.

PELTRY, PELTS. The dry, unprepared skins of animals.

PELVIS. The bony cavity situated at the lower part of the belly, formed by the sacrum and innominata bones.

PENCIL OF LIGHT. A divergent beam of small size.

PENDANT. In Gothic architecture, an ornamented polygonal piece of stone or timber hanging down from the vault or roof of a building. In ancient writers the springers of arches, which rest on shafts or corbels, are called pendants.

PENDENTIVE. In architecture, the portion of a vault between the arches under a dome.

PENDULOUS. Hanging, branching over.

PENDULUM. Any weight suspended by an inflexible rod, and moving freely about a point. Its oscillations, whether wide or limited, are always performed in the same period of time; but the period is directly as the square root of the length of the rod.

PENICILLATE. Furnished with small bunches of hair.

PENNYROYAL. *Mentha pulegium.* A kind of mint cultivated for its essential oil; used in medicine. The American plant is *Hedeoma pulegioides;* not a true mint, but its odor is similar to that of the European plant; many insects, among which especially ticks, are remarkably annoyed by its presence.

PENNYWEIGHT. Twenty-four grains, or one-twentieth of an ounce troy.

PENTAMERANS. Coleopterous insects, with five joints on the tarsus of each leg.

PENUMBRA. The partially dark outer shadow.

PEPO. The form of fruit similar to the melon and other cucurbitaceæ.

PEPPER. *Piper.* The black and white pepper of commerce is the fruit of a vine, grown principally in Java, Sumatra, Ceylon, and other tropical Asiatic countries. White pepper is the black pepper divested of its skin. There are numerous species of the genus. Red pepper, *capsicum,* is a name given to numerous herbaceous plants natives of tropical countries, but some varieties of which are cultivated in almost every garden for pickling. The pods are the parts used, being red or yellow when ripe. The red (cayenne) pepper of commerce, is the long, small, red pepper. The best soil is one that is rich, mellow, dry, and in a warm situation. One ounce of seed will yield between two and three thousand plants. The earliest sowing can be made in March, upon a gentle hot-bed; or delayed until the first part of May, in a sheltered border. Cover the seed near half an inch deep. When the plants are two inches high, they should be removed to their final location, to be set in rows two feet apart each way. Until they become established, protect them from the noonday sun; and occasionally, during all dry weather, give them gentle sprinklings of water. Keep the soil open and clean.

PEPPER GRASS, PEPPERWORT. Garden cress.

PEPPER, INDIAN. *Piper nigrum.* An endogenous climbing shrub of Sumatra, the fruit of which appears on spikes at three years, and forms the black pepper of commerce. The same, hulled by rubbing, constitutes white pepper. The celebrated betel, or intoxicating pepper, chewed by the natives of India with lime, (*chunam,*) is the fruit of the *Piper betel.*

PEPPERMINT. *Mentha piperita.* The genus mentha is an extensive one, comprising about sixty species. Among the more important, for use, are peppermint, spearmint, (*M. viridis,*) and pennyroyal, *M. pulegium.* Spearmint is used for sauces, salads, and in soups and stews, also for mixing with liquors; pennyroyal used to be employed in cooking; peppermint is distilled, and its oil formed into essence, in which form it partakes of the nature of all the labiate plants. The mints are all cultivated in a similar manner, only peppermint is much cultivated for commercial purposes. The soil should be rich, mellow, and moist. Divisions of the roots are dropped about six inches apart, about corn-planting time, in rows two feet apart and kept clear of weeds. When the plants come in blossom is the proper time to cut them, when they are carried immediately to the laboratory, where they are distilled. In case either of the mints are to be dried for use, it must be done in the shade, and the branches must not become wet in drying. For garden culture, plants may be set one foot apart each way. A plantation will last for years, but it is usual to renew it every three or four years.

PEPPER, WATER. (See Smartweed.)

PEPSIN. Albuminous matter of the stomach and gastric juice in a state of change. It forms the active agent of rennet; and, with muriatic acid, has been made to produce artificial digestion.

PER. A chemical prefix to those compounds which contain the highest proportion of the element against which it is placed; as peroxide, perchloride, etc.

PERCH. The one-fortieth of a rood, thirty and a quarter square yards; in long measure, five and a half yards.

PERCHERON HORSE. (See French Horses.)

PERCHERS. The Incessores, birds which perch on trees, including the Scansores and Passeres.

PERCHLORIC ACID. An acid consisting of one equivalent of chlorine with seven of oxygen, which forms a sparingly soluble compound with potash, the perchlorate, and has hence been used as a test for that alkali.

PERCOLATION. The slow oozing of water through rocks, earths, or other slightly porous structures.

PERENNIALS. Herbaceous plants whose roots live several years.

PERFOLIATE. Leaves through which the stem passes.

PERGAMENOUS. Parchment-like.

PERI. A common affix of descriptive terms, meaning about, or around.

PERIANTH, PERIANTHUM. A flower which has no distinct calyx.

PERICARDIUM. The membrane surrounding the heart: its inflammation is called pericarditis.

PERICARP. The outer portion of the fruit surrounding the carpels.

PERICRANIUM. The membrane which is attached to the bones of the skull.

PERIGYNIUM. The case formed in carices by the union of two bracts. The disk.

PERIGYNOUS. Stamens which are attached to the sides of the calyx.

PERIOSTEUM. The fibrous membrane attached to the surface of all the bones.

PERIPHERY. The circumference.

PERIODIC OPHTHALMIA. (See Eyes, Inflammation of.)

PERISPERM. The testa or covering of a seed.

PERISTALTIC. A worm-like motion of the intestines, produced by a contraction and dilation of their circular fibers, whereby their contents are pushed forward into the colon and rectum.

PERISTOMIUM. The fringed membrane surrounding the capsule of mosses.

PERITONEUM. The membrane which envelopes the organs of the abdomen; it is serous: its inflammation is called peritonitis.

PERMEABLE. Permitting the passage of fluids or gases.

PERRY. The cider of pears.

PERSIAN GOAT. (See Goat.)

PERSIMMON. *Diospyros.* The American persimmon, *D. Virginiana,* is a small tree, though sometimes it is found from forty to fifty feet high. It is common south of forty degrees and rare North, seldom being found as high as forty-two degrees. Grown if there is plenty of room, the tree is round topped or conical, rather open, and with the branches more or less twisted. The fruit varies from the size of a small plum to that of a medium sized peach, and when green is very astringent. When ripe or when mellowed with the frost, it is sweet and luscious, and generally liked. It is very much prone to sport, and hence it is supposed that it may be capable of wide improvement. In fact, in Japan there are exceedingly fine varieties in cultivation. Those imported have not proved hardy in the North. It is the *Diospyros kaki,* of the nurseries. The Japanese, by a course of cross fertilization and selection, it is said, have brought this fruit to great perfection. It is there a regular commercial fruit, and those not consumed at home are dried like figs which they resemble, and are exported. In the Indian Territory, where the persimmon is at home, and grows abundantly, the Indians use large quantities, and also preserve the fruit, making of it a preparation, after the manner of making apple butter. It is to be hoped that horticulturists, at the North, will select hardy varieties, and improve this fruit, so we may have it fresh in our markets. In fact the trade in shipping this fruit from southern Indiana and Illinois, during its season, to Chicago, has been considerable in former years, and is still continued; much of it, however, was unripe, and this prevented its use. To introduce any new fruit, especial care should be taken to have it prime. The wood of the persimmon is fine, hard grained, elastic and heavy, and is valuable for turning and other purposes. As an ornamental tree it is fine, and should be found in every collection up to the latitude of forty-two degrees, where it can have some protection in winter. The seed should be sown in the fall and transplanted at one year old. It is a tap rooted plant and therefore does not transplant well when older.

PERSONATE FLOWERS. Irregular, monopetalous flowers like the snapdragon, (*Antirrhinum,*) with an upper and lower lobe, but with the faux or throat closed; in this respect it differs from the labiate corolla.

PERSPIRATION. The function of the skin whereby a saline fluid with a little gaseous matter is thrown out of the body. It is increased by taking much fluid in summer; and the state of this excretion is closely connected with health.

PERUVIAN BARK. The bark of several varieties of cinchona trees of Central and South America; they furnish the alkaloid, quinine.

PETALS. The divisions of the flower; the leaves of the flower, usually of bright colors. Petaloid is a derivative.

PETIOLE. The leaf stalk.

PETROLEUM. Mineral or rock oil from which kerosene is distilled, giving rise to many by-products.

PETROSILEX. Hornstone, sometimes compact feldspar.

PETUNIA. This is one of the most valuable of garden plants, for planting in masses. It comes into bloom early, and continues to give a profusion of bloom until killed by frost in the autumn. The seeds are very minute, and hence require care in germinating. The best way is to sow them in a finely prepared bed, made pretty compact and simply press the seeds into the earth, keeping the surface moist until they germinate. When large enough, they may be transplanted where they are to bloom, at a distance of twelve inches apart each way. Some varieties show handsome striped single flowers; others are quite double. The plant should not be allowed to run. This may be accomplished by pinching back, and then training to stakes or a trellis, but for rich masses of bloom, they are most brilliant when allowed to run together. If the seeds be planted in July, and the plants potted and kept dwarfed by pinching back, they make handsome plants for pots or hanging baskets, giving a profusion of bloom all winter, but they should have a warm, sunny aspect and plenty of water, but with good drainage below to ensure the best success.

PETUNTZE. Porcelain clay and decayed feldspar.

PEWEE. Phebe-bird. *Sayornis fuscus.* A common and useful bird all over the North, arriving among the earliest in the spring. It is quite domestic and innocent of mischief, its food being seeds and insects. The nest is built under the eaves, or other projections where it may be dry, fine roots, moss, hair, and grass are used, being plastered together and also fastened to the support with mud. The eggs are five in number, white, with a delicate cream tint, and usually one or two are found in the nest with a few spots of reddish-brown thinly scattered on the larger end. Incubation lasts thirteen days, and usually two broods are reared in a season. The Wood Pewee (*Contopus virens*) makes its appearance later and prefers the solitude of the forest. It is, therefore, seldom seen. The nest is built on a horizontal limb composed of lichens, pine leaves, and mosses, the body of the nest being of wiry grasses or root fibers, bound together, says Nuttall, by cobwebs and caterpillar s silk, moistened with saliva; externally it is so coated over with bluish, crustaceous lichens as scarcely to be distinguished from the limb on which it is fixed.

The bird comes North rather late and leaves early. One brood only is reared in a season, incubation lasting fourteen days. The eggs are about the size of the Pewee, about three-quarters of an inch long by one-half inch broad, of a delicate cream color, spotted with two shades of lilac, one brown and the other lavender. Its food is insects and seeds.

PHAGEDENIC. Corroding ulcers.

PHALANGES. The small, long bones of the fingers and toes.

PHANEROGAMIA, PHANEROGAMOUS. Plants bearing flowers.

PHARYNGITIS. (See Sore Throat.)

PHEASANT. In some sections of the Middle States and in the South the ruffed grouse (*Tetrao umbellus*) is improperly called pheasant, just as it is called partridge in New England and some other sections of the North and West. The true pheasant (*Phasianus*) is not a native of the United States, but is kept in a semi-domesticated state in parks in England and on the continent of Europe, and occasionally in the United States. An observer, at the French exposition, writing to the Department of Agriculture, describes some of the varieties seen, as follows: The common pheasant (*Phasianus colchicus*) found in the wild state in the Caucasus and near the Caspian sea, is the most common species in Europe. It is a most beautiful bird, and has for a very long time been kept in a semi-domesticated state in the parks, woods, and pleasure grounds of wealthy persons, where it breeds almost as well as domesticated fowls. It roosts at night on elevated trees, and, like our domesticated Guinea fowls, loves to wander about the woods and fields. These birds ought by all means to be introduced into our ornamental parks and pleasure grounds, being at the same time useful as an article of food, as well as highly ornamental. There are five varieties here, viz: the common, the ring-necked, ash color, white, and particolored. The ring-necked pheasant is said to be originally from China. The male of the silver pheasant (*Phasianus nycthemerus*) originally from the north of China, is a most beautiful bird, of a silver white color, with regular, slender, lace-like black markings on the feathers of the back, while the under parts are of a black color; the long, drooping tail is also silver white, barred with black. This bird is said to be completely domesticated in France, where it is bred and reared with perfect ease. The female is by no means as beautiful as the male, being of a dull reddish color, and of a smaller size. The golden pheasant (*Phasianus, thaumalea, pictus*) is one of the most beautiful and bizarre birds, bred in a state of half-domestication, and is much smaller than either of the pheasants before mentioned. The under part of the male is of a red color, the head is ornamented with a splendid golden yellow crest, the neck is hidden or overhung by a somewhat projecting ruff of feathers of a bright yellow color, striped or barred with black. The wings are of a dull blue, the hind parts of the body are of a golden color, set off with red, and the tail is long and brown, barred with black. The female of this species is also very inconspicuous in color. These birds have bred well in some forests in Europe, and in a state of domestication have produced three varieties, viz: the ordinary golden and red color, the black, and the Isabella or fawn.

PHEBE-BIRD. (See Pewee.)

PHOSPHATE. A salt formed by a combination of phosphoric acid and a salifiable base, as lime, for instance. It is one of the most valuable of the mineral manures, since it is absolutely necessary in the formation of bone. Hence soils deficient in phosphate, plants cannot take it up, and hence again, grazing animals suffer for the want of this necessary constituent of bony matter. Phosphite is known as a salt formed by phosphorus and a salifiable base. Phosphorus is a yellowish transparent substance like wax, which in common air burns with great rapidity and vehemence. At ordinary temperatures it naturally attracts the oxygen of the air and burns spontaneously, emitting a luminous vapor originally obtained from wine. It is now chiefly obtained from bones, those of sheep being the richest. The principal sources of the phosphates of commerce are the minerals and rocks containing them and the bones of animals daily slaughtered, and also fossil bones. There are numerous phosphatic rocks and beds of fossil bones. The beds of fossil bones and rocks near Charleston, S. C., have of late years become celebrated, being principally the remains of fossil marine animals. They are extensive, easily worked, containing from twenty-four to thirty per cent. of phosphoric acid, ten to fifteen per cent. of which is available, being crushed and ground to powder in powerful mills, and then subjected to treatment by sulphuric acid.

PHOSPHITE. (See Phosphate.)

PHOSPHORUS. (See Phosphate.)

PHOTOMETER. An instrument to measure the intensity of light.

PHRENITIS. Inflammation of the brain.

PHRYGANIDÆ. Tricopterous insects, caseworm flies.

PHYCOMETER. The gelatinous matter in which the sporules of the lowest plants germinate.

PHYLLODIA. Leaves in which the petiole is very much expanded and the lamina absent.

PHYLLOXERA. (See Grape Insect.)

PHYSICS. Mechanical philosophy. The study of the properties of objects and their motions.

PHYSIOLOGY. The investigation of the properties and functions of plants and animals.

PHYTOGRAPHY. Descriptive botany.

PIA MATER. The delicate membrane covering the brain.

PIAZZA. An arcade.

PICAMAR. A bitter substance found in tar.

PICIDÆ. *Picæ.* The family of woodpeckers.

PICK. A pickaxe.

PICKLING. The preservation of vegetables or meats in vinegar or brine.

PICROMEL. Sugar of bile; bile changed by the action of acetic acid. The characteristic principle of bile.

PICROTOXIA. A poisonous alkaloid in *Cocculus Indicus.*

PIER. In architecture, the solid between the openings of a building, or that from which an arch springs. An abutment pier, in a bridge, is that next the shore.

PIG. (See Swine.)

PIGEON. The pigeon is bred in a domesticated state in every civilized country in the world, and is now broken up by breeding into an almost infinite variety of forms and characteristics.

PIGEON.

Their powers of flight are most astonishing, the carrier pigeon having been known to traverse 800 miles without food or rest. The wild pigeon (*Ectopistes migratoria*). is remarkable for its symmetry of form, the extreme rapidity and elegance of its flight, as well as for the incredible numbers which at times pass over different portions of our land, affording, seemingly with but little diminution in their crowded ranks, the millions killed during their flight. It propels itself by repeated flappings of the wings, bringing these at times closely to the body with firm strokes, and, before alighting, breaks the force of its flight by several rapid beats, as though fearing injury from coming too suddenly into contact with the object upon which it may desire to rest. It is supposed to be capable of moving through the air at the rate of a mile a minute; and it has been killed in New York with its crop yet filled with the rice collected in the fields of Georgia and South Carolina, which it must have left only five or six hours before meeting its death, because, as they digest their food rapidly, they must necessarily have traveled the distance within the time allowed, in order to have arrived with the rice still in its perfect state. The shape of their body is oval, with a sharp-pointed tail, admirably constructed for rapid evolutions, and also furnished with a pair of long wings, moved by large and powerful muscles. The rapidity with which this bird will pass through a wood is perfectly astonishing, threading its way amid the closely grown branches with unerring course, it flashes upon the sight like a meteor, and is gone. A pigeon-roost is a curiosity well worth a visit from any one who has the slightest fancy for the strange things in nature. No language can give a perfect idea of the appearance of one of these places, when occupied by its millions of tenants. Instances are known where these birds have covered the trees for a distance of forty to fifty miles in length, by three to five in breadth, every limb of every tree within that spacious extent loaded and groaning with the weight of the numberless pigeons clustered on it. When approaching these roosts their advance is heralded by a sound like the gale when it sweeps over the ocean in uncontrolled fury, the sky is darkened by their inconceivable numbers, and the noise of their flapping wings, as they stay the rapidity of their course, is like the sound of many waters. They come by thousands in a flock, and settle on the trees around, while frequently the confusion reigning everywhere is increased by great limbs breaking from the weight of the birds upon them, and falling with a crash, carrying death and destruction among those which have alighted beneath. Some of these places are resorted to annually by the birds, and the farmers, just before the time the pigeons usually appear, will assemble for the purpose of obtaining them. Sometimes the hogs are driven to the roost to be fattened on the birds which are slain. Guns are used to kill them, but often long poles are equally effective, for the pigeons make little or no effort to escape. They continue to arrive often until the night has far advanced, and the uproar is continued until daybreak, when they begin to move off, and when the sun rises the majority have departed. The flesh of the wild pigeon is dark, and by some is much liked. The young, or squabs, as they are termed, are very tender and delicate, and much more esteemed as food than the adult bird. The pigeon generally selects the tallest and largest trees to breed in, and as many as fifty nests may be counted upon a single tree. They lay only two eggs, elliptical in form, and of a pure white. When the young are about half grown, their enemies of every kind come to these places, and disturb the peaceful birds by endeavoring to get possession of them in all manner of ways. The quickest is to cut the trees down, and as one falls by coming in contact with another, it shakes all the squabs out of the nests, which may be on it, and soon the ground is covered with the little helpless things, and immense numbers are thus destroyed. The wild pigeon never rests at any great distance from water, to which it resorts several times during the day, and when it drinks immerses its bill up to the eyes, and so remains until its thirst is satisfied. Immense flocks of these birds are not so often seen now as formerly; the diminution of their number may be attributed equally to the destruction of our forests as to the birds themselves. and it is a rare thing in these days to witness, near the cultivated districts, any very great flight of pigeons. The skin is very tender and easily torn, while the feathers fall off at the least touch—characters peculiar to this family. The male of this species has the throat, breast, and sides brownish red, sometimes with a purplish tint, rest of under parts bluish white. Head blue; hind part and sides of neck changing to gold, green, and bright crimson. Upper part of body blue; wing coverts marked with black spots; quills blackish, tipped with white. Inside tail feathers dark brown, rest blue on the outer web, white on the inner. Bill black; feet red. The female has a similar distribution of colors, but very much duller than the male. These are olivaceous above and beneath pale blue instead of red; a slight tinge on the neck and the throat of a whitish color.

PIGEON BERRY. Poke. Poke-weed. Garget. *Phytolacca decandra.* A plant found growing in fence corners and other waste places. The root actively emetic; the stalk stout, smooth, and generally purple; leaves, ovate-oblong, bearing bunches of berries containing a dark purple juice, used sometimes as a substitute for red ink. The quite young shoots are sometimes used like asparagus, and a tincture of the ripe berries have been used as a remedy for chronic rheumatism. The root is also used in decoction as a local remedy for garget in cows. It is generally regarded and should be treated as a weed.

PIGGERY. (See Hog House.)

PILASTER. A square pillar situated in a wall, usually projecting not more than one-fifth or one-sixth of its width. Pilasters are subject to the same rules of proportion as columns.

PILCHARD. A small kind of herring.

PILE. The hair on furs.

PILES. Timbers driven into a marshy soil to afford a better foundation. In surgery, enlargement of the veins of the rectum.

PILEUS. The cap of a mushroom.

PILOSE. Hairy, set with hairs.

PIMENTO. *Myrtus pimenta.* Allspice. The aromatic berries of an evergreen tree of Jamaica and the tropics of America.

PIMPERNEL. *Anagallis arvensis.* A pretty, indigenous annual.

PINDARS. *Arachis hypogœa.* The ground pea. (See Peanut.)

PINE. *Pinus.* The pine is perhaps the most valuable of any single genus of trees to man. It embraces a great number of species, including those from which tar, pitch, and turpentine are manufactured, others furnishing masts, and deck timber for ships, and the white pine, *P. strobus*, furnishing the soft, easily worked, and valuable lumber for dwellings, and a great variety of uses in carpentry and joiner work. So again, many of the species are highly ornamental, and are used extensively in planting. Some of the finest of these are natives of the Rocky mountains. Among foreign trees the Austrian pine and Scotch pine are well known. Of our native species, one from the Pacific coast, the ponderous pine, (*Pinus ponderosa*) is hardy and of rapid growth, see illustration, page 726. The wood is very heavy, as its name indicates, and is of rapid growth. The white pine a native of the entire North and Canada, is, however, one of the best of trees for prairie planting, being quite hardy, doing well on a variety of soils, and it also bears the shears or cutting well. The pines have been divided as follows: 1. White pine, five leaves in a sheath, which includes the Cembran pine and the Bhotan pine. 2. Pitch pine, three leaves in a sheath, which includes Loblolly and ponderous pine. 3. Two leaves in a sheath, as Scotch pine, Austrian pine, red pine, gray pine, scrub pine, yellow pine, etc. The white pine species like a rather moist, rich soil. The pitch pines grow on the most blowing sands, and the two leaved pines do well as a rule on rather a stiff soil.

PINEAL GLAND. A gland of the brain.

PINE APPLE. *Bromelia ananas.* A refreshing fruit of tropical America, with dry, spiny, leaves. It is an annual growing from the crown of the fruit. From the leaves, by maceration, a delicate filament is obtained, from which exceedingly fine fabrics are made.

PINION. A small wheel playing in the teeth of a larger one. It is only a spindle or arbor.

PINKS. *Dianthus.* A class of highly ornamental plants, biennials and perennials, all, however, requiring protection in the winter in the North, and some like the carnation, requiring to be kept in the house in winter. The characteristics of excellence in pinks are that the flowers should be circular in outline when viewed in front, semi-globular in profile, and uniform in size on the same plant. The petals should have good substance whether the edges be cut or smooth each row smaller than that preceding it. Self colors, should be uniform in tint, variegated colors should have the ground white, lacing, whatever the tint, should be unbroken and have a border of white beyond it, and the color of the lower limb of the petal extending so as to be seen above the white edge of the petals above. (See Floriculture.)

CHINA PINKS.

PINK ROOT. *Spigelia Marilandica.* Carolina pink. A handsome perennial, growing about the borders of woods in the South; the roots are used in infusion as a powerful vermifuge; the dose for children of three years is ten grains of the powder; in very large doses it proves a dangerous narcotic.

PINNACLE. A square or polygonal pillar rising above a building, and terminating in an ornamental pyramid.

PINNATE. Leaves with separate leaflets arranged along the midrib, or petiole; some are doubly pinnate.

PINNATIFID. Imperfectly pinnate. In this case the leaflets are not distinct, but a portion of the lamina runs along the central petiole. Cut-leafed.

PINT. The eighth part of a gallon; half a quart.

PIP. The seeds of apples, pears and similar fruits. (See Nuts.) In poultry, a disease or rather the result of disease. The formation of a dry, horny scale on the tongue of the fowl; the beak grows yellow at the base, the plumage ruffled, and untidy, the bird is moping, and eats but little and very soon refuses food altogether, and at length dies of fever. A remedy is to give the bird two or three grains of black pepper, twice or three times a day, in fresh butter for a week. The treatment, however, should vary with the cause, and the disease treated as for any malignant disease, as catarrh, gapes or roup, which close the nostrils, obliging the fowl to breathe through its mouth will cause the occurrence of this dry horny scale.

PIPE. A wine measure, 105 imperial, or 126 wine gallons.

PIPE CLAY. White clay, disintegrated feldspar, with which the white smoking pipe and coarse pottery are made.

PIPE DRAIN. (See Draining.)

PIPERIN. A white, crystalline, inactive alkaloid, obtained from black pepper.

PIP FRUITS. (See Nuts.)

PISCICULTURE. (See Fish Breeding.)

PISE. In building, a wall constructed of stiff earth or clay, carried up in moulds, and rammed down as the work is carried up. The expression, building *en pise*, is common.

PISOLITE. Native limestone moulded into grains, like peas.

PISTACHIO NUTS. *Pistachia vera.* A turpentine tree, a native of Syria; the nuts are the size of small filberts, of a sweet taste and pleasant flavor resembling almonds. There are edible nut-bearing pines in the Rocky mountains, and in the Sierra Nevada mountains, in the United States.

PISTIL, PISTILLUM. The central organ of flowers, it is divided into an ovarium, or lowest part, a style, and stigma, which last is the uppermost surface, and receives the fertilizing pollen. It is called the female organ, because flowers in which it is absent are barren. Pistils are made of one or more carpels, the styles of which unite. Flowers with pistils only are termed pistillate.

PISTON. A short cylinder of wood or metal, which fits exactly the cavity of a pump or barrel, and is worked up and down in it alternately. Two sorts of pistons are used in pumps: one hollow, with a valve, used in the sucking pump; and the other solid, which is employed in the forcing pump.

PITCH. The substance that remains after boiling or distilling tar.

PITCH OF A ROOF. Its inclination to a level plane.

PITHING. The operation of killing animals suddenly and without loss of blood, by driving a knife into the spinal marrow; this is done by directing the knife to the space between the first and second vertebra, next the head.

PITTACALL. A blue substance obtained from oil of tar.

PITUITARY GLAND. The pineal gland, situated in the base of the brain.

PITUITARY MEMBRANE, SCHNEIDERIAN MEMBRANE. The mucous membrane of the nostrils.

PITYRIASIS, DANDRUFF. A scurfy disease of the skin.

PIVOT. The extremity of an axle which revolves in a socket or hole.

PLACENTA. The afterbirth. A large spongy organ which receives the blood of the mother, and supplies, by the umbilical artery, the fœtus. In botany, cellular tissue developed within a carpel, to which the ovules are attached sometimes by an umbilical cord.

PLAITED, PLICATE. In botany, folded like a fan.

PLAGUE. A name locally applied to various malignant diseases of live stock, as Rinderpest, Pleuro-pneumonia, Texas, or Spanish Fever, Murrain, and various diseases. (See articles on these various subjects.)

PLANARIA. A genus of flat entozoic animals, which do not, however, inhabit the bodies of other animals.

PLANE. A flat surface.

PLANE TABLE. A square board, furnished with a compass, and with lines drawn on its upper side, used in taking angles and in measuring land.

PLANE-TREE. The button-wood.

PLANER-TREE. *Planera ulmifolia* (*aquatica.*) A tree of twenty-three to thirty feet height, growing in swampy places, in the South and Southwest, and resembling the elm. The wood is hard and strong, but there is only a small amount of it.

PLANIPENNATES. Neuropterous insects with flat wings, the lower pair of which equal the upper.

PLANKS. Boards of nine inches or more in width, and two or more inches thick.

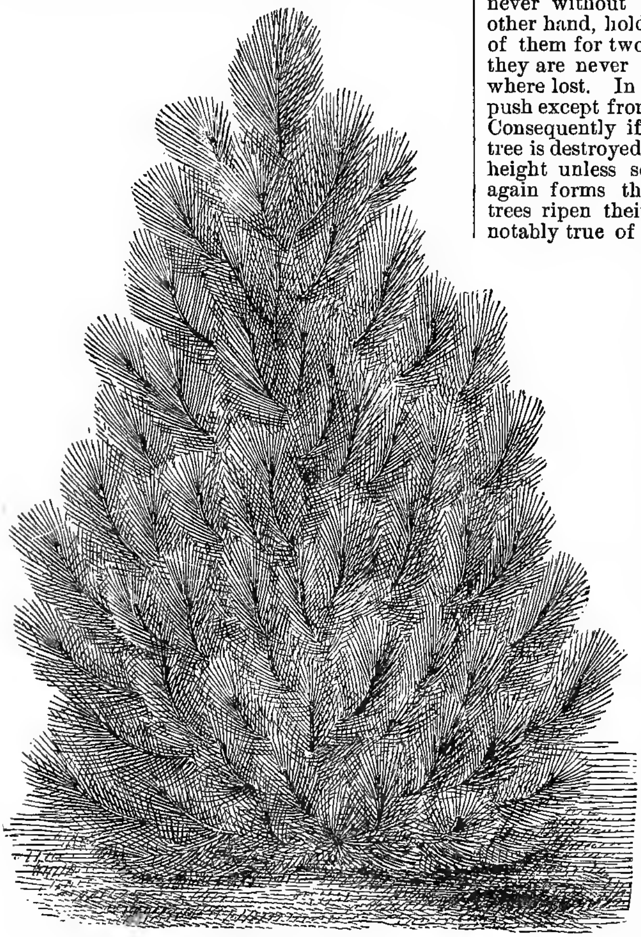
PLANO-CONCAVE. A thin disk, having one surface flat and the other curved inward.

PLANT. An organized vegetable body, adhering to another body, and drawing nourishment therefrom, or which grows in water without any fixed hold. Thus the term includes any vegetable substance which has life, including trees, shrubs, bushes, herbs, grasses, vines, orchids—which fasten to trees—fungus mosses, lichen, algæ, vegetables and flowering plants. The term however is generally applied to the smaller herbaceous vegetables, and flowering plants.

PLANTAIN. *Plantago.* The common plantain of roadsides, door-yards and waste places, has been called by the Indians the white man's foot, from its being an attendant on emigration; the seeds being found carried in a variety of ways. It is a worthless weed, though its leaves are convenient and excellent for dressing blisters and sores. It is an introduced biennial weed from Europe. Rib grass, or English Plantain (*P. lanceolata*), has a perennial root, and is found in meadows and pastures, seeding in midsummer and again in the autumn. Stock eat the plant freely. It is difficult to eradicate once in the land, since the seeds are of the size and weight of red clover.

PLANTATION. A term used: 1. To denote a large farm, devoted to special crops as sugar, cotton, rice, tobacco, etc.; 2. Any nursery or plot of trees of a given kind. In the North it is used in the latter sense chiefly, and in the South, to denote the farm or estate of the owner.

PLANTER. 1. In the South, the owner of a farm or estate devoted to special crops. In the North, one who plants by dibbling, or otherwise transplants any plant. 2. Any machine for planting special seeds, in hills; or machines for planting a variety of seeds in contradistinction to a drill which sows consecutively in a continuous line.



PINUS PONDEROSA.

PLANT LIFE IN WINTER. It would seem that the freezing point of the sap—the blood in a sense—of a tree or plant may not be really frozen without destroying the life, or at least severely injuring its vitality. So different plants have different freezing points, that is, the degree of cold that will destroy one class of plants, will not injure others. For instance, a white frost will kill sweet potato, egg plant, and various other tender natives of the tropics, while corn—a semi-tropical plant—resists a greater degree of cold. Celery will survive until the thermometer sinks to fifteen degrees Fahrenheit. Cabbage and other plants of the brassica tribe have their freezing point still lower, while many of our conifera remain active during our severest winters. It is more than probable that the active principle in the sap may not be frozen without killing the tree, and that notwithstanding the fact that the sap of our deciduous trees seems frozen in the winter, the circulation goes on to a greater or less extent. Certainly it does in our cone-bearing trees, or evergreens, as they are generally termed. A very popular error is the belief that evergreens hold their leaves persistently. This, however, is not the case. The so-called evergreens of the North—we are now speaking of true leaved plants—as the holly, ivy, laurel, etc., change their leaves as do the strictly deciduous trees, that is, the mature leaves drop off, and are replaced with others, but this change is made gradually, and the replacement goes on as the mature leaves are lost. So the tree is never without leaves. The conifera, on the other hand, hold their leaves persistently, some of them for two or more years. Once they fall they are never replaced by foliage in the place where lost. In these plants leaf buds do not push except from the extremity of the branches. Consequently if the leading branch of such a tree is destroyed, it never thereafter increases in height unless some branch turns upward and again forms the leader. Some of our forest trees ripen their seeds in the winter. This is notably true of some of the cone-bearing trees. These trees are positively active with the thermometer far below the freezing point. A half active circulation goes forward at all times, just as it does with hybernating animals. During mild spells in winter, this circulation becomes easily apparent, as may be shown by chipping the wood. The sap will immediately exude, and this is by no means confined to the evergreen species. It is known to take place with many of our deciduous varieties, the maples being notable examples of this kind. This circulation is in fact necessary to support and mature the buds. If the buds are killed, then indeed active circulation ceases, and the plant dies. All perennial plants, therefore, have a summer medium and a winter medium of activity. Exhalation is going on to a greater or less extent, constantly through the buds, and the green surfaces of the bark, and this activity is entirely governed by the degree of heat. Thus a season of mild weather in winter will cause such activity in the sap, that the buds will sometimes break into leaf. If we carefully dissect and examine one of these, even when apparently dormant and inactive, we shall find it to be composed either of the blossom or blossoms, or else of a cluster of true leaves, exactly folded and compressed together—and in the smallest possible space—and air and water tight, so far as outward influences are concerned; the outer layers being covered either by a system of hairs, or else with a resinous or glutinous secretion, which resists the direct action of water. All living trees, therefore, have their summer and their winter foliage. The buds that are now maturing to develop into full foliage next spring and summer, were started early last spring, and have been the growth of the whole summer and autumn. During the season of active growth of the tree, or in late spring and summer, but little sap is needed for their growth. The demands of the leaves and the other portions of the plants are then almost supreme. They, however, come on slowly, and as the summer wanes and autumn comes on, and as the leaves become mature, the sap is diverted more strongly to the buds, until at last they are perfected. These germs contain the future glory and beauty of blossom, foliage, growth and fruit of the coming year. Thus when we speak of trees or plants being bare of foliage during winter, we mean only relatively. Growth is constantly going on while the tree lives, though to the superficial observer it may not be apparent. The winter foliage requires but little nutrition, it is true. It requires protection during the inclement season; this the envelopes afford, holding life intact until the advancing sun of the succeeding spring again calls the full powers of the tree or plant into renewed activity,

PLANTS, EFFECT OF AIR AND LIGHT ON. White is said to be no color at all. It is, however, tangible enough to our sense of sight. It would seem to be the primary color, because the so-called decolorization of a substance results in white. Air and water, in a fluid state, are colorless, but they reflect any color that may be placed against them. Frozen water—pounded ice and snow—however, becomes white from its power of reflecting that color. One of the effects of air and light upon plants, is to cause them to change color. The embryo plant, as formed within its integuments, is usually white or nearly so, and a plant, colored by contact with light and air, may usually be blanched by shutting out the light, the blanching being perfect or otherwise, according to the thoroughness with which the light is excluded from the plant. Thus, in blanching celery, it is covered with earth to such a depth as to entirely shut out the light when it becomes thoroughly white, and also crisp. Lettuce or endive, however, is blanched by tying the leaves together, and is only partially blanched and crisped, for, it is blanched only in proportion to the quantity of light excluded. But some plants—such as rhubarb—develop color although grown in the dark, but this is from the pre-existence of color in the root from whence the stalk sprang. Or the deposition of coloring matter may take place as in some varieties of potatoes, beets, carrots, etc., being first formed by parts developed in the light. Flavor, as well as color and nutritive matter, is dependent also upon light for its presence, because flavor is produced by chemical alterations, caused by the exposure of the plant to the light. A very curious fact connected with this, is that the portion of a fruit, as a watermelon, shielded from the light, will not be as sweet as that portion receiving the full effect of light. It will also be remarkably retarded in the development of saccharine matter, from the absence of light and heat. Hence gardeners sometimes place slates or some other conductor beneath such fruits as they wish to be very fine and well developed. On the other hand, the sugar-beet is remarkably deficient in saccharine development in that portion growing above ground, and contains instead certain salts, which neutralize, partially in the manufacture of them, the saccharine contained in the portion below. It is a curious fact, and well worthy the investigation of agricultural scientists, from the possibilities which may be wrought out from its study. Light is also indispensable to the development of the nutritive matter which is formed by the exposure of the leaves to the light. Thus the potato, when forced in the dark, is said to contain no more farinaceous matter than was contained in the original tuber, and it is also a well known fact that fruits grown in illy-lighted and unventilated houses, are innutritious and flavorless. Light being so powerful a stimulus in vegetative economy, its energy in exciting the vital action of plants is in direct proportion to its intensity, hence the superior quality of fruits grown in a sunny and equable climate like California over those cultivated in less favored zones. So also the intensity of color in the leaves of a plant is in proportion to the light and heat which they receive, being paler in a more diffused light than when they are exposed to the more direct solar rays. During the prevalence of light, the leaves of plants absorb carbonic acid, and part with oxygen, and thus purify the atmosphere for the use of man and animals, and this process again, goes on just in proportion to the intensity of the sun's rays to which the leaves are exposed. The decomposition of carbonic acid, and the acquisition of carbon in a solid state, by the plant, is hastened or retarded in proportion to the amount of light received. So also the intensity of color and quantity of secretions are in proportion to their exposure to the light and air, as is shown by the deeper color of the upper portion of the leaves of plants. This is further proved by the fact that plants grown in a medium from which light is excluded, form neither color nor secretions—as in the blanching of celery, previously noticed. As plants derive an essential portion of their food from the air by the action of light, therefore those greenhouses and conservatories that admit most light are best adapted to the forcing and cultivation of plants. It has been found by experiment that light passes more freely through a curvilinear than through a plain roof, and through glass forming an acute angle with the horizon than through glass placed perpendicularly. Consequently a plane roof, with perpendicular glass sides, is the worst possible form for greenhouse purposes. As light passes more freely through clear, thin, colored glass, the former should only be used. Poisonous gases, in very minute quantity, act with great energy upon vegetation. A ten thousandth part of sulphuric acid gas is quickly fatal to the health of plants. Hence the sickly appearance of many forms of vegetation, especially evergreens in cities. The trouble with gases from the old-fashioned flue, has pretty generally led to their abolition in greenhouses, and to the introduction, instead, of heating by means of hot water. The process has now become so simplified, and so easily worked, that a man who should put up a permanent greenhouse or a conservatory to be heated by the old-fashioned flue, would be laughed at by practical men. They are only admissible, at best, in temporary structures. It is only within a comparatively few years that scientific men have given their attention to the practical investigation of the phenomena connected with agriculture. The conclusions of mere book theorists have done much to retard the progress of real agricultural science. Governments have waked up to the importance of scientific agricultural investigations. When the mere theorizing stage shall have passed away with us, as it is passing away in Germany and some other European countries, then and not till then shall we begin to make true progress in the right direction.

PLASHING. A mode of repairing or making a hedge by bending down a portion of the shoots, cutting them half through near the ground, to render them more pliable, and twisting them among the upright stems, so as to render the whole effective as a fence, and, at the same time, preserve all the branches alive. For this purpose, the branches to be plashed or bent down must not be cut more than half through, in order that a sufficient portion of sap may rise, to keep alive the upper part of the branches. (See Fences.)

PLASTER. (See Gypsum.)

PLASTIC. Capable of being moulded, adhesive.

PLATBAND. A square moulding, projecting from the wall less than its width.

PLATE. In building, a timber lying horizontally on a wall to receive the ends of girders, joists, rafters, etc.

PLATFORM. A level structure of any materials, to receive a superincumbent building.

PLATINUM, PLATINA. A metal, of the appearance of silver, but very infusible, and of specific gravity 21.5. It resists most chemical reagents, and is used in chemistry for crucibles, and in foil and wire for numerous purposes.

PLATYPHYLLUM. The *Katydid*, which see.

PLATYSOMES, PLATYSOMA. A family of coleoptera with wide and flat bodies, living under the bark of trees

PLEASURE GROUNDS. Grounds laid out in shrubberies, groups of trees, winding walks, and lawns. (See Landscape Gardening.)

PLESIOMORPHISM. A term used to denote a similarity between different crystals in their angles, but not an identity.

PLETHORA. An unnatural condition from rich food, and little exercise, and especially impure air in the stable. There will be a variable appetite, a dull eye, sometimes more or less bloodshot, languor, and loss of glossiness in the coat. In extreme cases, in connection with gentle exercise and pure air, two or three ounce doses of aloes may be given twice a week, and an ounce of saltpetre given in the water as often. Generally, a few bran mashes, in connection with gentle daily exercise and good ventilation, will set all right.

PLEURA. The serous membrane surrounding the cavity of the chest, lungs, and heart; it consists of two parts, which are united along the middle, and forms the *mediastinum*. Its inflammation is called *pleuritis*, or pleurisy.

PLEURISY. This is an inflammation of the membrane lining the chest and lungs, followed by watery exudation pressing on the lungs, and may occur on one or both sides. It is occasioned by a variety of causes, direct violence, colds, or it may follow pleuro-pneumonia and bronchitis. The attack is characterized by a chill, coldness of the skin, and great pain, followed by stiffness, soreness, rapid and incomplete breathing, hard, quick pulse, and a short, hard dry cough. At the first symptoms, give at a dose three ounces of laudanum in half a pint of linseed oil, and repeat in a few hours if it do not check the disease. Clothe the animal warmly, foment the sides over the pain faithfully with hot water, and give plenty of water to drink, with an ounce of saltpetre to the bucket, once or twice a day. If the attack be followed by weakness, scanty urine, and a pulse of seventy or eighty beats a minute, apply a mustard liniment to the chest sufficient to produce considerable heat, but not to blister. In connection with this give twice daily half an ounce of chloride of iron in a bucket of water. If effusion of water takes place in the chest, it must be drawn off by a trochar. Divide the skin with a lancet between the eighth and ninth rib; stretch the opening so that when it returns it will cover the place punctured by the trochar; plunge it into the sac, and allow the water to flow. Sometimes a second tapping is necessary.

PLEURO-PNEUMONIA. Simple pneumonia is one of the most common of the dangerous inflammations attacking, either the human family or animals. It is the name given to an inflammation of the parenchyma, (the spongy substance contained in the interstices between the blood vessels of the viscera). In acute pneumonia, the first stage is engorgement; the second stage is hepatization, (the red softening of Andral, or converting the lung into a substance resembling the liver); the third and fatal stage is purulent infiltration of the lung. In the first stage the lung is externally of a dark or livid red color, sometimes accompanied with a violet hue, from a slight whitish opacity of the pleura. (The membrane which covers the inside of the thorax, and also invests the lungs.) On cutting into the lung during this stage, a bloody serum flows from it more or less clear, and containing numerous air bubbles. The substance cut into will be red, of various shades of crimson, dark red, brown red, chocolate red, or of a livid-puce color approaching to black; and the progress of the inflammation may be known by the defect of air in the tissue, and consequent crepitation (crackling sound) upon pressure or tapping; the more crepitation the less the inflammation. The progress toward the second stage being marked by a paler color, a diminished quantity of both serum and air, and an increasing solidity. In another variety of inflammatory engorgment, the lung is extremely lived, and being cut, exudes more or less slowly a dark grumous (clotted) blood. This especially occurs in cases of pneumonia complicated with other acute affections, as fevers. It is supposed also to have relation to the state of the blood, more than to the degree of inflammation present. In the second stage the lung is solid, elastic to the touch, of the consistence and weight of liver, and portions of it sink in water. There is no longer crepitation. Neither when cut does it yield bubbles of air, but when pressed a bloody fluid exudes sparingly from it. Its friability is increased, the fingers readily rupturing its substance, and if a portion of it be pressed between the fingers, it becomes a homogeneous pulp. It is apparently larger than natural, and when taken out it retains its full size, while a healthy lung, when cut from the body, collapses. Its color is seldom so deep as in the first stage; cut into, it is also lighter, the shade varying from a blood or livid red, to a light pinkish purple, or the color of muscle, these colors will mottle the lungs, as is seen in some specimens of marble, and scattered through the hepatized portion, lines are visible, of a lighter color, and specks almost white. Generally when cut and examined with a lens, a number of points can be distinguished, like grains of a somewhat lighter color than the intervening spaces; if the surface be wiped or lightly scraped, these grains appear slightly elevated, as though they were of a more solid nature. If the hepatized lung be torn these granules will be little ovoid bodies, and may be detached from the tissue. Generally these grains are pressed closely together so as to form the chief portion of the lung; sometimes there are interstices of a darker color, and sometimes the granular appearance is altogether absent; the granular appearance, however, is one of the evidences of hepatization, but there is a variety of hepatization. Thus sometimes a lung in a state of red hepatization,will weigh ten times that of a healthy lung. The advance of a hepatized lung toward the third stage is marked by its becoming lighter in color and less humid, supposed to be produced by a substitution of more of the yellowish-white semi-solid albumen of the red particles in its substance, by which the deep red or dull red of hepatization passes into a salmon-color or a dingy pink, variously marbled in the degree of its progress, as well as by the mixture of black pulmonary matter. At this time the hepatized lung attains its greatest solidity, and, when pressed slightly, exudes a turbid red liquid; greater pressure reduces the substance to a thick pulp. Minute yellowish-white specks can be discerned, the first development of pus (matter,) then the third stage, or rather the third effect of inflammation, is purulent infiltration. The red tinge assumes a yellowish hue or stone color, varied with red in parts less advanced, and with gray, blue, or bluish-green, from the admixture of black pulmonary matter. On cutting into it during this early stage of suppuration, no matter exudes; the cohesion of the texture is still sufficient to retain it, but slight pressure reduces it to a state in which pus forms the principal part. At first yellow, as the stage progresses the color changes to a straw or sulphur yellow, beginning in patches and spreading through the mass; cutting into the lung shows no granular texture, but a greater or less oozing of a yellowish, opaque purulent will take place, according to the progress of the suppuration, the solid matter diminishing, as the pus is secreted, and squeezing this out nothing remains but the debris of pulmonary tissue, except so far as granulation may remain in which suppurations have not advanced. The softness of the lung in this state is so great that a slight pressure of the finger will make a cavity which is immediately filled with pus. In a more advanced stage of purulent infiltration, a lens will sometimes enable us to detect that only a remnant of texture is left, consisting of an irregular network, composed chiefly of vessels, bronchi, and the septa (partitions) of lobules (lobes). Pneumonia may be lobar, lobular, or vesicular, according as it affects whole or continuous parts of lobes or certain polygonal subdivisions of these, or single bunches of vesicles. Lobar inflammation is the most common, and inflammation of the upper lobes is the most fatal in the human subject. Inflammation often attacks single, or a few isolated lobules, being abruptly limited by the interlobular cellular tissue, so that lozenge shaped or polygonal patches of red, engorged or hepatized tissues are found in the midst of healthy structures. The inflammation in lobular pneumonia seems to originate in several points at once, and not to be sufficiently intense to traverse the barrier of the interlobular membrane. This form sometimes occurs subsequent to injuries, and to the young. Vesicular pneumonia presents itself in the form of little red spots, from the size of a pin's head to that of a hemp seed, and showing upon dissection blood red or livid red, more fragile than the rest of the tissue, which is sometimes quite healthy. In ordinary cases of pneumonia the pleuritic affection is slight, scarcely modifying the disease, and like the inflammation of the bronchi, which is as usual an accompaniment of pneumonia, is to be viewed as incidental rather than essential to the disease. The pleuritic inflammation will be modified by the seat and extent of the pulmonary disease. When partial that portion of the pleura which covers it has upon it an albuminous deposit, which is generally thin, and the disease being of sufficient duration will show signs of organization. When the pulmonary inflammation is of small extent, there is commonly a small sero-purulent effusion into the pleural sac; extensive hepatization prevents this by filling the pleural cavity with its own unyielding substance, and the lung is then partially covered with a thin, false membrane, thicker along the edges, in the interlobular fissure, and occasionally at some points when the inflammation was first extended to the pleura. We have thus stated the appearance and conditions as seen by the anatomist in various stages of pneumonia in the human subject. The same disease will present nearly similar conditions in farm animals. Inflammation of the lungs, or pneumonia, may be produced by causes producing other acute diseases of the chest. From over exertion, acute congestion, or the result of parasites in the lungs. The first stage of pneumonia may be acute congestion of the lungs. The nostrils will be dilated; the breathing will be quick, wheezy, labored and convulsive; the head will be extended, the eye staring, blood shot, and indicating intense pain: the nasal membranes will be deep red or blue, and the pulse feeble, and often scarcely indicated at the jaw. By feeling behind the left elbow, the heart will be found beating tumultuously, perspiration will break out on different parts of the body, but the limbs will be cold. Auscultation, listening with the ear to the chest, will show a loud murmur of respiration, and a slight crepitation or crackling. If the case is extreme, blood letting from the jugular vein will be indicated. It will be dark or tarry in appearance. Remove all that may interfere with easy breathing and comfort. Keep the head of the animal to the wind and give immediately a strong stimulant, five or six ounces of whisky for the horse, and double this dose for the ox; or, liquid ammonia, one-half ounce for the horse, and double this for the ox or, ginger, or pepper tea, if these be not at hand. Cover the animal with thick blankets.

wrung out of hot water, and cover over all with dry ones. Give friction by rubbing to the limbs and all parts not enveloped by the blankets. If the animal get better, feed on light but nourishing food, including grass, if possible, and give rest, warmth, and good care until entirely recovered. If the animal does not soon show signs of recovery, the attack will probably end in pneumonia. There will be shivering if the attack be not preceded by congestion of the lungs, and, usually, a dry cough. There will be quick, labored breathing, hot skin, the pulse full and rolling, but oppressed. The membranes of the eyes, nostrils, and mouth will be red; the cough deep, but, perhaps, not especially hard or painful. If the legs be held apart, it denotes a severe case. There will be crepitation, by auscultation, over the affected part of the lung, which will show the extent of the inflammation. Percussion (striking) over the affected part will cause extreme pain. Thus, when there is no sound by auscultation, percussion will show a dull, solid sound, while the rest of the chest retains a healthy, drum-like resonance. Thus, by listening and tapping (percussion) the hepatization (solidification) of the lung may be followed, and the increase or diminution of the disease followed from time to time. As the disease becomes worse a yellowish or whitish discharge may come from the nose. In cattle, as the breath is expired, there will be a moan; the horns and ears will be hot, the muzzle dry, the skin tight, the dung hard, if any, and the urine scant and high colored. Give the animal a dry, airy, but warm stall, if the weather is cold, avoid all drafts, clothe the animal warmly, rub the limbs with ammonia liniment (ammonia and oil), and bandage with flannel, and apply a mustard poultice to the sides of the chest, also to the sides. If cattle or hogs, mix turpentine with the mustard poultice, or cover with blankets wrung out of hot water, and when taken off, let it be a little at a time, and rub thoroughly dry, and clothe warm, following with the mustard plasters, if necessary. Give injections of warm water, and warm gruel to drink. A laxative will be good if there is not a low fever and depression. If there is much depression, give tincture of aconite, twenty to thirty drops for a horse, and thirty to forty drops for an ox. For swine, give tartar emetic, five grains. If there is great prostration after the fever has subsided, give sweet spirits of nitre, one ounce three or four times a day, and for the ox, two to three ounces. As the animal recovers, give light, nourishing food, with rest, and often moderate exercise, avoiding drafts. Pleuro-pneumonia contagiosa, the dreaded cattle plague of England, contagious pleuro-pneumonia, or contagious lung fever of the United States, is the most to be dreaded, as it is the most insidious of all our animal scourges, and one, once it gets a general foothold in a country, has never yet been known to be radically stamped out. In 1839, this dread disease was communicated to stock in Ireland from some Dutch cattle taken there. It appeared in England in 1842, in various parts of Europe, the Cape of Good Hope and Australia, since that time. It was first brought to Brooklyn in 1843, and again in 1850, to New Jersey in 1847, to Massachusetts in 1859, and again it made its appearance in New York a few years since, and spread throughout the adjacent States, even reaching Virginia in the South. The most energetic measures were taken by the several States, the cattle of which were infected, for the purpose of stamping it out. Whether this will really be accomplished successfully, remains to be seen. If not it must eventually overrun the whole country. So far as we have been able to learn, no well authenticated case has yet been found, or at least it has not spread, west of the Alleghanies. There have been reports of cases from time to time, and one during the summer of 1880, that it had made its appearance in Kansas. Upon following the matter closely there was found no good foundation for the report, and like the rest, the report was probably started by persons who sought to make money by passing cattle through Canada for exportation. In view of the necessity of accurate information in relation to this disease, and its characteristic symptoms, we append sufficient information in relation thereto, for if once it gets a firm foothold among the great herds of the West, it will remain indefinitely, and cost millions of dollars annually in the attempt to keep it in check. No successful remedy has yet been found for treating this dread disease. Isolation, and good nursing may save some cattle, but generally at a cost greater than their value for beef. Its period of incubation is from ten days to three months, by a low fever, the occurrence of inflammation in the air passages, lungs and their coverings, followed by exudation into the lungs and pleura. Infection may be by contact with animals infected; by inoculation, through contact with the remains of diseased animals or their excretions, or by inoculation of the virus of an infected animal. It is fairly well authenticated, that the infection may be carried in the air for considerable distances, and very certainly the vitality of the virus may remain indefinitely in infected situations, as fields and especially in stables, if they be not most thoroughly disinfected. It is more than probable that in the majority of cases the infection is taken into the lungs by breathing, since the disease begins when the inspired air may lodge the germs. The lesions are concentrated there, beginning with cloudiness and swelling of the smaller air tubes and the surrounding connecting tissues. However taken the poison is multiplied, and in an immeasurably greater degree when taken into the lungs, than by other means. When the fever has run its course, if the animal become apparently well to the ordinary observer, the ox may have a good appetite and gain flesh, the cow may give milk freely, and seem in perfect health, yet from three, even to fifteen months after, it is claimed the disease may be transmitted. How? The circulation in the most severely infected portion of the lungs is interrupted; the exudation is developed into a tough fibrous envelope, which shuts off the dead mass from the adjacent lung, and from communication with the adjacent air. This dead mass now undergoes a process of breaking down, liquefaction, and absorption commencing at the surface and advancing slowly toward the center. Thus as it undergoes no change, except that of liquefaction, and exhales at no time a putrid odor, it remains infectious so long as it retains the solid form. Therefore whenever there are indications of the existence of these encysted masses, the animal must be infectious, and kept from contact with others precisely as in the acute stages of this dread disease. Hence we say that once an animal is found infected it is cheaper for the owner to kill it at once, slash the hide—to make it worthless to ghouls who might dig up the body—and bury it deeply in the earth, covering it, if possible, with quicklime. The following is the diagnosis of the disease as seen by a committee appointed to investigate this disease in New York. They say: The first symptoms of pleuro-pneumonia seldom attract much attention, and the disease commonly steals on without manifesting any great violence; the animal appears dejected, and, when in the field, separates itself from its fellows, often getting behind a wall, hedge or other shelter to keep out of the wind. As the disease progresses, it becomes uneasy, loses its appetite, and stops chewing the cud; the eyes appear dull, the head is lowered, the nose stuck forward, the nostrils expanded, and the horns and skin are warmer than common. With failure of the appetite, thirst may continue and increase. In cows, the milk falls off, either gradually or altogether. It is seldom that the first progress of the disease attracts much notice until the animal stops eating. Cough, although often accompanying the disease, is by no means a constant symptom. When, however, the pleura or lining membrane of the windpipe or the bronchial tubes become inflamed, loud and harsh coughing is a never-failing symptom. Pressure between the ribs and along the spine causes the animal to wince. The breath grows warmer and often fetid, the danger rapidly increasing, of course. The animal will often press her muzzle very hard against the partition, as if for support, will breathe with great difficulty, and soon dies.' The progressive symptom varies greatly, however, in different animals, but the cough is the key-note of the disease, and appears in all. There can be no longer room to doubt that the disease is contagious or infectious. It seems to be communicated by animal poison in the air, proceeding from the lungs and breath or respiratory surfaces of a diseased animal, and any animal of the same species coming in contact or within the influence of this vitiated air, is very liable to be infected. In relation to the treatment of the disease, we have fully stated our opinion that killing and burying infected animals is the only safe plan, and isolating the herd containing it or them, and continuing to kill and bury all that give evidence of the disease. The better way would be to immediately kill all that were fat, and not affected with the disease, bury the viscera and sell the meat. Of course no person would sell the meat or hide of a diseased animal. To be a common highwayman or murderer, would be innocence as against such a fiend. If the infected ones are to be killed and the rest isolated, Prof. Gamgee advises in the first stage of the disease, to an ox, daily doses of sulphate of iron, linseed, and aniseed, of each from one-half to one drachm, the whole to be well mixed and given in bran. The food throughout the disease should be light and nutritious In the second stage give copious warm water injections, and, as a stimulant two or three times a day, one-half ounce carbonate of ammonia, and one quart linseed oil. For the cough and debility during convalescence the following tonic to be given daily is advised: Oxide of magnesia, one-quarter ounce; iron filings, very fine, one-half ounce; tincture of gentian one and a half ounces; rain-water, one pint. Yet we again advise the cheapest as well as the most humane way, to kill every animal infected. All authorities agree that both lungs being affected there is no hope of recovery, and we may add, the infection from an animal with one lung, or one lobe of a lung infected is as deadly as though both of them were completely rotten. The latest report to the United States Government, 1879, gives much matter that will be of special interest everywhere among all classes of farmers, the gist of which we give: The virulence and infectious nature of the disease does not seem to have been lessened by its transplantation to this country. Many instances are given which show conclusively that it is equally as fatal to-day in those localities in the United States, in which it exists, as it is in its home in the far East, or in those nations of Europe which it has invaded. Speaking of the contagious and infectious nature of the malady, Dr. Law says: No one who has studied the plague in Europe can truthfully claim that it is less infectious here than in the Old World. What misleads many is, that during the cooler season many of the cases assume a subacute type, and others subside into a chronic form with a mass of infecting material (dead lung) encysted in the chest, but unattended by acute symptoms. But this feature of the disease renders it incomparably more insidious and dangerous than in countries where the symptoms are so much more severe, that even the owners are roused at once to measures of prevention. In moderating the violence of its action, the disease does not part with its infecting qualities, but only diffuses them the more subtilely in proportion as its true nature is liable to be overlooked. A main reason why unobservant people fail at first sight to see that the lung fever is contagious is, that the seeds lie so long dormant in the system. A beast purchased in October passes a bad winter, and dies in February; after having infected several others. She has had a long period of incubation, and when the disease supervenes actively, she has passed through a chronic form of illness, so that when others sicken, people fail to connect the new cases with the infected purchase. Then, again, in an ordinary herd of ten or twenty head the deaths do not follow in rapid succession, but at intervals of a fortnight, a month, or even more, and those unacquainted with the nature of the disease suppose that it can not be infectious, or all would be prostrated at once. The disease may be communicated by immediate contact, through the atmosphere for some considerable distance, by the inhalation of pulmonary exudation when placed in the nostrils, from impregnated clothing of attendants, through infected buildings, infected manure, infected pastures, infected fodder, etc. Healthy cattle have been contaminated after being lodged in stables that were occupied by diseased ones three or four months previously. Hay spoiled by sick cattle has induced the disease after a long period, and pastures grazed upon three months before have infected healthy stock. The flesh of diseased animals has also conveyed the malady; and it is recorded by Fleming that the contagion from cattle buried in the ground infected others fifty or sixty feet distant. There seems to be much difference of opinion with regard to the power of the virus to resist ordinary destructive influences. Under ordinary circumstances, it will be preserved longest where it has been dried up and covered from the free access of the air. In close stables and buildings having rotten wood-work, or deep dust-filled cracks in the masonry, and in those with a closed space beneath a wooden floor, it clings with the greatest tenacity. Again, in buildings which contain piles of lumber, litter, hay, fodder, or clothing, the virus is covered up, secreted, and preserved for a much longer period than if left quite empty. In such cases it is preserved as it is in woolen or other textile fabrics, when carried from place to place in the clothing of human beings. As carried through the air, the distance at which the virus retains its infecting properties varies much with varying conditions. Dr. Law states that he has seen a sick herd separated from a healthy one by not more than fifteen yards and a moderately close board fence of seven feet high, and in the absence of all intercommunication of attendants, the exposed herd kept perfectly sound for six months in succession. At other times infection will take place at much greater distances without any known means of conveyance on solid objects. Röll quotes fifty to one hundred feet, while others claim to have known infection transmitted a distance of from two hundred to three hundred feet. But the author questions whether, in such cases, the virus had not been dried up on light objects, like feathers, paper, straw, or hay, which could be borne on the wind. Because the lesions are concentrated in the lungs, and begin with cloudiness and swelling of the smaller air tubes and surrounding connective tissues, the presumption is favored that the virus is usually taken in with the air breathed. Its progress and the results of all attempts at inoculation would seem to confirm this. The exudation into the interlobular tissue, the congestion of the lung tissue itself, and the implication of the lung covering, are regarded as secondary phenomena, or, in other words, the disease begins where the inspired air must lodge the germs. The inoculation of the virulent lung products on distant parts of the body transfers the seat of the disease to the point inoculated, and in such cases the lesions of the lungs are not observed, or at least are not greatly marked. A diseased animal is more likely to infect a healthy one at that period when the fever runs highest and the lung is being loaded with the morbid exudation. Proof appears to be wanting as to the infecting nature of the affection during the incubation stage, but it must not be inferred that with the subsidence of the fever the danger is removed. It is a matter of frequent observation that animals which have passed through the fever, and are again thriving well and giving a free supply of milk, and to ordinary observers appear in perfect health, retain the power of transmitting the disease to others. This may continue for three, six, nine, twelve, or, according to some, even fifteen months after all signs of acute illness have disappeared. The number of animals infected by contact or exposure to the contagion is somewhat irregular, as is also the virulence and fatality of the disease. The French commission of 1849 found that of twenty healthy animals exposed to infection sixteen contracted the disease, ten of them severely. Dr. Lindley gives examples, from his South African experience, in which whole herds of eighty, one hundred and thirty, and even of several hundred died without exception, showing that in warm climates the mortality is greatest. Dr. Law found the disease much more virulent and fatal during the hot summer months in New York, and says that during the winter season it is far less violent in its manifestations, and a great number of animals resist it. Lung plague confines its ravages entirely to the bovine genus, and no race, breed, or age is exempt from its attacks. Sex gives no immunity; bulls suffer as much as cows; and oxen and calves, if equally exposed, furnish no fewer victims than bulls and cows. As in rinderpest, measles, scarlatina, and the different forms of variola, an animal once afflicted with lung plague is usually exempt or impervious to a second attack. Only occasional instances are given where an animal has suffered from a second attack. The losses caused by the plague ranges all the way from two to sixty-three per cent. of all the animals in the country or locality in which it prevails, the losses varying according to climate, surroundings, condition of stock, etc. The period of latency, that is, the time that elapses between the receiving of the germs into the system and the manifestation of the first symptoms of the disease, varies greatly. Veterinarians differ as to their experience and statements, and set this period at from five days to three months. Dr. Law has seen cases in which cattle have passed three or four months after the purchase in poor health, yet without cough or any other diagnostic symptom, and at the end of that time have shown all the symptoms of the lung plague. It is this long period of latency that renders the disease so dangerous. An infected animal may be carried half way around the world before the symptoms of the malady become sufficiently violent to attract attention, and yet all this time it may have been scattering the seeds of the disease far and wide. The average period in inoculated cases is nine days, though it may appear as early as the fifth, or it may not till the thirtieth or fortieth day. In the experimental transmission of the disease by cohabitation, under the French commission, a cough, the earliest symptom, appeared from the sixth to the thirty-second day, and sometimes continued for months, though no acute disease supervened. Hot climates and seasons abridge the period of latency, as the disease has been found to develop more rapidly in summer than in winter, and in the South than in the North. A febrile condition of the system also favors its rapid development. Of the symptoms of the disease, Dr. Law says: These vary in different countries, latitudes, seasons, altitudes, races of animals, and individuals. They are, *cæteris paribus*, more severe in hot latitudes, countries, and seasons, than in the cold; in the higher altitudes they are milder than on the plains; in certain small or dwarfed animals, with a spare habit of body, like Brittanies, they appear to be less violent than in the large, phlegmatic, heavy-milking, or obese short-horn Ayrshires and Dutch. A newly-infected race of cattle in a newly-infected country, suffer much more severely than those of a land where the plague has prevailed for ages; and finally certain individuals, without any appreciable cause, have the disease in a much more violent form than others which stand by them in precisely the same conditions. Sometimes the disease shows itself abruptly with great violence and without any appreciable premonitory symptoms, resembling in this the most acute type of ordinary broncho-pneumonia. This, however, is mostly in connection with some actively exciting cause, such as exposure to inclement weather, parturition, overstocking with milk, heat, etc. Far more commonly the symptoms come on most insidiously, and for a time are the opposite of alarming. For some days, and quite frequently for a fortnight, a month or more, a slight cough is heard at rare intervals. It may be heard only when the animal first rises, when it leaves the stable, or when it drinks cold water, and hence attracts little or no attention. The cough is usually small, weak, short and husky, but somewhat painful and attended by some arching of the back, an extension of the head upon the neck, and protrusion of the tongue. This may continue for weeks without any noticeable deviation from the natural temperature, pulse, or breathing, and without any impairment of appetite, rumination or coat. The lungs are as resonant to percussion as in health, and auscultation detects slight changes only, perhaps an unduly loud blowing sound behind the middle of the shoulder, or an occasional slight mucous rattle, or a transient wheeze. In some cases the disease never advances further, and its true nature is to be recognized only by the fact that it is shown in an infected herd or on infected premises, and that the victim proves dangerously infecting to healthy animals in uninfected localities. It may be likened to those mild cases of scarlatina which are represented by sore throat only, or to the modified variola known as chicken-pox. In the majority of cases, however, the disease advances a step further. The animal becomes somewhat dull, more sluggish than natural, does not keep constantly with the herd, but may be found lying alone; breathes more quickly, twenty to thirty times per minute in place of ten to fifteen; retracts the margins of the nostrils more than formerly; the hair, especially along the neck, shoulders, and back, stands erect and dry; the muzzle has intervals of dryness, and the milk is diminished. The eye loses somewhat of its prominence and luster; the eyelids and ears droop slightly, and the roots of the horns and ears and the limbs are hot or alternately hot and cold. By this time the temperature is usually raised from 103° F., in the slightest or most tardy cases, to 105° and upward to 108° in the more acute and severe. Auscultation and percussion also now reveal decided changes in the lung tissue. The ear applied over the diseased portions detects in some cases a diminution of the natural soft-breathing murmur, or it may be a fine crepitation, which has been likened to the noise produced by rubbing a tuft of hair beween finger and thumb close to the ear. Where this exists it is usually only at the margin of the diseased area, while in the center the natural soft murmur is entirely lost. In other cases a loud blowing sound is heard over the diseased lung, which, though itself impervious to air and producing no respiratory murmur, is in its firm, solid condition a better conductor of sound and conveys to the ear the noise produced in the larger air-tubes. Percussion is effected by a series of taps of varying force delivered with the tips of the fingers of the right hand on the back of the middle finger of the left firmly pressed on the side of the chest. Over all parts of the healthy lung this draws out a clear resonance, but over the diseased portions the sound elicited is dull, as if the percussion were made over the solid muscles of the neck or thigh. All gradations are met with as the lung is more or less consolidated, and conclusions are to be drawn accordingly. In other cases we hear on auscultation the loud, harsh, rasping sound of bronchitis, with dry, thickened, and rigid membranes of the air-tubes, or the soft, coarse, mucus rattle of the same disease when there is abundant liquid exudation, and the bursting of bubbles in the air passages. In others there is a low, soft, rubbing sound, usually in jerks, when the chest is being filled or emptied. This is the friction between the dry, inflamed membrane covering the lungs and that covering the side of the chest, and is heard at an early stage of the disease, but neither at its earliest nor its latest stage. Later there may be dullness on percussion up to a given level on one or both sides of the chest, implying accumulations of liquid in the cavity, or there is a superficial dullness on percussion, and muffling of the natural breathing sound with a very slight, sometimes almost inaudible, creaking, due to the existence of false membranes (solidified exudations) on the surface of the lung or connecting it to the inner side of the ribs. This is often mistaken for a mucous rattle that can no longer take place in a consolidated lung in which there can be no movement of air nor bursting of bubbles in breathing. The mucous rattle is only possible with considerable liquid exudation into the bronchial tubes, and a healthy, dilatable condition of the portion of the lung to which these lead. In rare cases there will be splashing sounds in the chest, or when the patient has just risen to his feet a succession of clear ringing sounds, becoming less numerous and with longer intervals until they die away altogether. These are due to the falling of drops of liquid from shreds of false membrane in the upper part of the chest through an accumulation of gas into a collection of liquid below. It has been likened to the noise of drops falling from the bung-hole into a cask half filled with liquid. Peculiar sounds are sometimes heard, as wheezing, in connection with the supervention of emphysema, and others which it is needless to mention here. In lean patients pressure of the tips of the fingers in the intervals between the ribs will detect less movement over the diseased and consolidated lung than on the opposite side of the chest where the lung is still sound. As seen in America, in winter, the great majority of cases fail to show the violence described in books. The patients fall off rapidly in condition, show a high fever for a few days, lie always on the same side (the diseased one) or on the breast, and have a great portion of one lung consolidated by exudation and encysted as a dead mass, and yet the muzzle is rarely devoid of moisture, the milk is never entirely suspended, and may be yielded in only a slightly lessened amount as soon as the first few days of active fever have passed. During the extreme heats of summer, on the other hand, the plague manifests all its European violence. The breathing becomes short, rapid, and labored, and each expiration is accompanied by a deep moan or grunt, audible at some distance from the animals. The nostrils, and even the corners of the mouth are strongly retracted. The patient stands most of its time, and in some cases without intermission, its fore legs set apart, its elbows turned out, and its shoulder-blades and arm-bones rapidly losing their covering of flesh, standing out from the sides of the chest so that their outlines can be plainly seen. The head is extended on the neck, the eyes prominent and glassy, the muzzle dry, a clear or frothy liquid distils from the nose and mouth, the back is slightly raised, and this, together with the spaces between the ribs and the region of the breast-bone, are very sensitive to pinching; the secretion of milk is entirely arrested, the skin becomes harsh, tightly adherent to the parts beneath, and covered with scurf, and the arrest of digestion is shown by the entire want of appetite and rumination, the severe or fatal tympanies (bloating,) and later by a profuse watery diarrhœa in which the food is passed in an undigested condition. If the effusion into the lungs or chest is very extensive, the pallor of the mouth, eyelids, vulva, and skin betrays the weak, bloodless condition. The tongue is furred, and the breath of a heavy, feverish, mawkish odor, but rarely fetid. Abortion is a common result in pregnant cows. During the summer the disease shows its greatest violence, and it is then that its mortality is not only high but early. The great prostration attendant on the enormous effusion into the organs of the chest, the impairment of breathing, and the impairment or suspension of the vital functions in general, causes death in a very few days. In other cases the animals die early from distension of the paunch with gas, while in still others the profuse scouring helps to speedily wear out the vital powers. In certain severe cases the rapid loss of flesh is surprising. Dr. Law says that in such cases a loss of one third of the weight in a single week is by no means uncommon, and even one-half may be parted with in the same length of time in extreme cases. In fatal cases all symptoms become more intense for several weeks, the pulse gradually becomes small, weak, and accelerated, and finally imperceptible; the breathing becomes rapid and difficult, the mucous membranes of the mouth, eyes, etc., become pale and bloodless, emaciation goes on with active strides, and death ensues in from two to six weeks. Sometimes, in cold and dry weather, a portion of dead lung may remain encysted in the chest, submitting to slow liquefaction and removal, and such animals will go on for months, at last to sink into such a state of debility that death ensues from exhaustion and weakness. In still other cases the retention of such diseased masses, and the consequent debility, determines the appearance of tuberculosis, from which the animal dies. Purulent infection and rupture of abscesses into the chest are also causes of death, but the author states that no such cases have come under his observation. Dr. Law gives the following description of the *post mortem* appearances, which we give for the information of those somewhat versed in physiology. If the disease is seen in its earliest stages, the changes are altogether confined to the tissue of the lung. From the examination of the lungs of several hundred diseased animals, I can confidently affirm that the implication of the serous covering of the lung (pleura) is a secondary result. In all the most recent cases we find the lung substance involved and the pleura sound, while in no one instance has the pleura been found diseased to the exclusion of the lung tissue, or without an amount and character of lung disease which implied priority of occurrence for that. Yet, in all violent attacks the disease will have proceeded far enough to secure implication of the pleura as well, and hence we may describe the changes in the order in which they are usually seen when the chest is opened. The cavity of the chest usually contains a quantity of liquid varying from one or two pints to several gallons, sometimes yellowish, clear, and transparent, at others slightly greenish, brownish-white, and opaque, or even exceptionally slightly colored with blood. This effusion contains cell-forms and granules, and gelatinizes more or less perfectly when exposed to the air. On the surface of the diseased lung, and, to a less extent, on the inner side of the ribs, is a fibrinous deposit (false membrane) varying from the merest rough pellicle to a mass of half an inch in thickness, and, in the worst cases, firmly binding the entire lung to the inside of the chest and to the diaphragm. These false membranes are usually of an opaque white, though sometimes tinged with yellow, and, in the deeper layers, even blood-stained, especially over an infarcted lung. A feature of these false membranes, and one that serves to distinguish them from those of ordinary pleurisy, is that they are commonly limited to the surface of the diseased portion of lung, or, if more extensive, that portion which covers sound lung tissue is much more recent, and has probably been determined by infection from the liquid thrown out into the chest. In the lung itself the most varied conditions are seen in different cases and at different stages of the disease. The diseased lung is solid, firm, and resistant, seems to be greatly enlarged, because it fails to collapse like the healthy portion when the chest is opened; is greatly increased in weight, and sinks in water. When cut across it shows a peculiar linear marking (marbling) due to excessive exudation into the loose and abundant connective tissue which separates the different lobules of the ox's lung from each other. This exudation is either clear, and therefore dark, as seen by reflected light, or it is of a yellowish-white, and when filled with it the interlobular tissue appears as a network, the meshes of which vary from a line to an inch across, and hold in its interspaces the pinkish-gray, brownish-red, or black lung tissue. When only recently attacked the lung may present two essentially different appearances. Most frequently the changes are most marked in the interlobular connective tissue, which is the seat of an abundant infiltration of clear liquid, a sort of dropsy, while the lung tissue, surrounded by this, retains its normal pinkish-gray color, and is often even paler, and contains less blood than in health. It has, in short, become compressed by the surrounding exudation, and air and blood have been alike in great part expressed from its substance. This extreme change in the tissue surrounding the lobules and the comparatively healthy appearance of the lobules themselves, have led many observers to the conclusion that the disease commenced in the connective tissue beneath the pleura and extended to the proper tissue of the lung. There is, however, as pointed out by Prof. Yeo, a coexistent disease of the smaller air-tubes corresponding to the lobules that are circumscribed by this infiltration, and there is every reason to believe that the infiltration in question is the result of antecedent changes in the air-tubes. Less frequently we find the lobules of the lung tissue presenting the first indications of change. The lobules affected are of a deep red, and more or less shining, yet tough and elastic. They do not crepitate on pressure, yet they are not depressed beneath the level of the adjacent healthy lung-tissue, as they would be if collapsed. The interlobular connective tissue, devoid of all unhealthy exudation, has no more than its natural thickness, and reflects a bluish tint by reason of the subjacent dark substance of the lung. Here the lung tissue itself is manifestly the seat of the earliest change—congestion—and the interlobular exudation has not yet supervened. Specimens of this kind may be rare, but a number have come under the writer's observation, and in lungs, too, that presented at other points of their substance the excessive interlobular exudation. Both of these forms show a tendency to confine themselves to particular lobules and groups of lobules of the lung. They correspond, in short, to the distribution of particular air-tubes and blood vessels. The fact, however, is noteworthy as characteristic of the disease, that it attacks entire lobules, and the limits of the diseased lung tissue are usually sharply marked by the line of connective tissue between two lobules, so that one lobule will be found consolidated throughout, and the next in a perfectly natural condition. The two forms just described differ also in cohesion and power of resistance. The lung saturated with the liquid exudation has its intimate elements torn apart, and is more friable, giving way readily under pressure, while that in which there is red congestion, but no extensive exudation, retains its natural elasticity, toughness, and power of resistance. Another condition of the diseased lung-tissue, more advanced than either of those just described, is the granular consolidation or hepatization. In this condition the affected regions of lung are as much enlarged as in the dropsical condition, but they are firmer and more friable, and on their cut surface present the appearance of little round granules. These granules are not peculiar to the lung tissue proper, though most marked on this; they characterize the interlobular connective tissue as well. They consist mainly of lymphatic cell growths, filling up the air cells, the smaller air-tubes, the lymph spaces, and the meshes of the connective tissue. The color of these portions varies from a bright reddish-brown to a deep red, according to the compression to which the lung tissue has been subjected by the exudation in the early stages. Another form of lung consolidation is of a very dark red or black, and always implies the death of the portion affected. The dark aspect of the diseased lobules forms a strong contrast with the yellowish-white interlobular tissue, except where that also becomes blood-stained, when the whole presents a uniform dark mass. This form has the granular appearance of that last described, and on microscopic examination its blood-vessels are found fully distended with accumulated blood globules. This black consolidation is always sharply limited by the borders of certain lobules or groups of lobules, which are connected with a particular air-tube and its accompanying blood-vessels, and the artery leading to such lobules is as constantly blocked by a firm clot of blood. The mode of causation is this: the artery, being in the center of a diseased mass, becomes itself inflamed. As soon as the inflammation reaches its inner coat, the contained blood coagulates; the vein is usually blocked in the same way. The blood formerly supplied by the artery to certain lobules is now arrested; that in the capillary vessels of those lobules stagnates; nutrition of the walls of the capillaries ceases, and these, losing their natural powers of selection, allow the liquid parts to pass freely out of the vessels, leaving the globules only in their interior. More blood continues to enter them slowly from adjacent capillaries supplied from other sources, and as this is filtered in the same way by the walls of the vessels, these soon come to be filled to repletion by the globules only; and hence the intensely dark color assumed. The color is often heightened by the escape of blood from the now friable vessels into the surrounding tissue, and it is by this means that the interlobular tissue is usually stained. This black hepatization, or, as it is technically called, infarction, is an almost constant occurrence in the disease as seen in New York, and the death and encysting of large portions of lung is, therefore, the rule. If too extensive, of course, the patient perishes, but not unfrequently a mass of lung measuring four or six inches by twelve is thus separated without killing the animal. If at a later stage we open an animal which has passed through the above condition, the following may be met with: A hard, resisting mass is felt at some portion of the lung, usually the lower and back portion, and on laying it open it is found to consist of dead lung tissue, in which the hepatized lobules and interlobular tissues, the air-tubes, and blood-vessels are still clear and distinct, but the whole is separated from the still living lung by a layer of white pus-like liquid, outside which is a dense, fibrous sac or envelope, formed by the development of the surrounding interlobular exudation. From the inner surface of this dense cyst, the firm, thick bronchial tubes and attending vascular systems project in a branching manner like dirty white stalactites, and these, with the interlobular tissue thickened by its now firmly organized exudation, may form bands extending from side to side of the cavity. At a still more advanced stage the dead and encysted lung tissue is found to have been entirely softened, and the sac contains nothing but a mass of white liquid debris, or, still later, a caseous mass of its dried, solid matters, upon which the fibrous covering has steadily contracted, so as to inclose but a mere fraction of its original area. In hundreds of *post mortems* we have only once seen the dead and encysted lung the seat of putrid decomposition, and never found the cavity opening into a previous air-tube. There remains to be noticed the condition of the air-tubes and accompanying vessels in the diseased lungs. In all cases where we see the starting point of the disease we find in the small tubes leading to the affected lobules a loss of the natural brilliancy of the mucous membrane, which has become clouded and opaque, and the tissue beneath it infiltrated and thickened. In more advanced cases, and above all in those showing the dropsical condition of the interlobular tissue, we find a similar infiltration into the connective tissue around the air-tubes and their accompanying vessels, and in the hepatized lung this is always seen as a thick, firm, resistant, white material, having the compressed and contracted and often plugged air-tubes and vessels in the center. These thickened masses have already been referred to as standing out in stalactite form from the inner wall of the sac in which the dead (necrosed) lung is undergoing solution. As to the nature of the plague, Dr. Law states that there can be no doubt but it is determined by an infecting material conveyed in some manner from one beast to another. The intimate nature of this material has never been determined: No special anatomical element, no specific organism of animal or vegetable origin, has been detected as constant in the diseased organ and peculiar to it, yet the presence of a specific contagium has been fully demonstrated in all the experience of the disease by the author and others. This infecting material, as shown by the records of inoculation, rarely affects the lungs when first lodged on a raw surface of some other part of the body, differing in this essentially from most other specific disease poisons, which have a definite seat of election in which their morbid processes are always established, no matter by what channel communicated. Since this contagium does not usually affect the lungs when introduced by some other channel, it follows of necessity that when it does attack the lungs it must have been introduced directly into them. If inhaled in the air breathed, it will fall upon one of two points—the air-tubes or the air-cells —and there begin its baleful and destructive course. This is exactly in accordance with the early lesions of the disease as found by Dr. Law in his post-mortem examinations. Following is given a brief summary of the work of the New York commisson in its efforts to stamp out the disease in that State; but as the department has later advices from the author in regard to the work actually accomplished by this commission, extracts from Dr. Law's letter are given in preference to quotations from this monograph work. The letter bears date of New York city, December 9, 1879, and contains, among other things, the following: To place our work in a nutshell, I would say that in the past ten months the inspectors of New York have examined 40,000 head of cattle, many of them several times; that we have slaughtered and indemnified the owners for 500 head of diseased cattle, and that we have all but exterminated the plague from seven of the counties in which we found it. At present the main center of the plague is in King's county and the adjacent border of Queen's county. In all country districts, where the cattle are kept on enclosed farms, and where the people heartily co-operated, the work has been easy, and in every case speedily crowned with success. In the cities and suburbs, on the other hand, where cattle had been accustomed to graze on open lots where interchange between different herds was frequent, and where the facilities for secret slaughter easily favored the covering up of the disease, the greatest difficulties had to be overcome. In New York city we secured the hearty co-operation of the police, and effectually arrested all movement between city stables, allowed only sound animals from healthy counties to enter these stables, and none to leave save to immediate slaughter, and, finally, promptly slaughtered all acute and chronic cases of the disease and saw to the disinfection of the premises and the most gratifying success crowned our efforts. In Brooklyn, on the other hand, where our work was systematically opposed, where the aldermen defied the State law by passing an ordinance authorizing the pasturage of cattle on open commons and unfenced lots, and some of them signed special permits for the movement of cattle in defiance of General Patrick's authority, and where magistrates dismissed offenders who were brought before them and reprimanded the policemen who had made the arrests, we soon lost the assistance of the police, which was at first all we could wish, and we naturally failed to meet with the splendid success seen in New York. It became evident early in the work that unless we could establish special inspection yards under our own control, and abolish the system of distributing cows and other store cattle from dealers' stables, our success would be very partial and slow. In New York we were enabled to do this through the liberality of the Union Stock Yard Company, who built new yards for this purpose, which we opened July 1. In Brooklyn no such favor awaited us, and as the appropriation made by the legislature would not meet the needful outlay and enable us to hold what we had gained until the legislature should again meet, we had to be content with a system which was confessedly ineffective. By the end of August the approaching exhaustion of the appropriation compelled the dissmissal of one-half of our veterinary force, and soon after we had to stop nearly all indemnities and consequently nearly all killing. Fortunately, New York City was now so nearly sound that we could continue the work there with but one inspector in addition to the one in attendance at the Union Stock Yard, and we could still kill and indemnify for all sick cattle in the city. Brooklyn, still widely infected, and with authorities still somewhat inimical, could only have her infected herds quarantined, and in her the scourge is but very partially abated. In certain outlying districts most gratifying results have been secured. In May we learned that animals from an infected herd had been turned on the Montauk pasture on the east end of Long Island. The range was visited and eighteen animals killed to save the 1,100 that remained. Later, two other cases developed in animals that had been in infected herds and had been overlooked at the first visit. Fortunately, for some months at first the cattle turned on this immense range kept apart from each other in small groups, composed of such only as had herded together prior to their coming on the range, and this most fortunate condition, coupled with the prompt disposal of each animal as it sickened, secured the escape of 1,100 animals. Had the occurrence been later in the season, when the cattle had learned to come together into one great herd, the results must have been most disastrous. A second case is that of Putnam county in which the plague had been smouldering since 1878. The State appropriation would not warrant us to offer indemnities, but the county authorities promptly assumed the responsibility, and every herd in which infection was found to exist was at once exterminated. In this way six herds have been disposed of, where sickness has existed for months. As regards the future, it is strongly urged that the National

Government assume not only the direction, but the execution of the work of stamping out the plague. The following among other reasons for this are given: The disease is an exotic, and if once suppressed could only reappear in America as the result of importation. It is gradually extending, and if neglected must lay the entire continent under contribution. If it reached our unfenced ranges in the West it would be ineradicable, as it has proved in the European Steppes, in Australia, and in South Africa. As the seeds remain latent in the system for three months, infected cattle may be moved all over the continent, from ocean to ocean and from lakes to gulf, and live for a length of time in a new herd before they are suspected. Old cases with encysted masses of infecting matter in the lungs may show no obvious signs of illness, and may be bought and sold as sound and mingle with many herds in succession, conveying infection wherever they go. There is, therefore, the strongest temptation for the owner to seek to secure a salvage by the sale of apparently sound but really infected animals. There is further the strongest probability that in a new locality these cattle would not be suspected until one or more herds had been irretrievably ruined. The infection of the South and West would inevitably spread the infection over the whole Middle and Eastern States, as infection would pour in continuously through the enormous cattle traffic, and all rolling stock, yards, etc., of railways would become infected. The live stock bears a larger proportion to the State wealth West and South than in the East, hence the West has most at stake in this matter, and should bear its share in the work of extermination. The plague is more violent in proportion to the heat of the climate, so that it will prove far more destructive in the semi-tropical summers of the South and West than on the Atlantic seaboard. No State can be rendered secure unless all States are cleared of the pestilence. One remaining center of infection on the continent is likely to prove as injurious, as the one infected cow landed in Brooklyn in 1843, the sad fountain of all our present trouble. It has been decided by a United States Supreme Court in Illinois, that a State law forbidding the introduction of cattle from a neighboring State, because it is feared they may introduce disease, is unconstitutional. Therefore each State must keep a guard along its whole frontier, with quarantine buildings, attendants, and inspectors, and must quarantine all cattle as soon as they shall have crossed. Smuggling is inevitable so long as there are distinct authorities in two adjacent States. Rascally dealers have repeatedly run cattle into New York from New Jersey, sold them, and returned with their money before the matter could be discovered and the law officers of New York put on their track. Were the law and execution one for all the States, such men could be apprehended and punished wherever found. In Europe it is found that an armed guard with intervals of 200 yards patroling the whole frontier day and night is not always sufficient; how much less, therefore, with us a law that can be evaded with such impunity. Finally, there is little hope of Delaware, Maryland, and Virginia stamping out the plague at their own expense, so that unless the United States takes the matter up, the work of New York, New Jersey, and Pennsylvania will be but money thrown away. This is a matter which threatens with dire disaster the inter-State live-stock trade of the future, and the National Government is called upon to stamp out the scourge with the view of protecting the trade between States. As respects the organization that should be charged with the work, it certainly ought to have a responsible head, and while the live-stock interests should be represented, it should not be made too unwieldy to act at a moment's notice in any emergency. The conditions of success are well enough understood, and while special adaptations would be demanded in many localities, yet the work should be carried out actively without the necessity of calling together a large and unwieldy committee, before anything can be done. Another point of vital importance is that a sufficient sum of money should be appropriated for this exclusive purpose, to obviate the necessity of stopping the work or giving it a material check before success shall have been accomplished. Any material arrest or any entire cessation of the work and a renewed spread of the disease will bring the question of veterinary sanitary work into disrepute, and may be the means of indefinitely and fatally postponing further action. While a large sum should be appropriated, its expenditure may be sufficiently guarded, but above all, it should not be a common fund to be devoted to this and other objects. Aside from the moral question, this is of far more immediate importance than even yellow fever, the germs of which are destroyed by frost, and the neglect of which for one year places the sanitarian in no greater difficulty for the next. With a disease like the lung plague, which is favorably affected by no change of climate nor season, and the germs of which survive all extremes of heat and cold, the loss of a year, a month, or even a day, may make the difference between an easy success and a disastrous and irremediable failure—a live-stock interest which can supply the world with sound beef, and a general infection of the continent, and continuous embargo on the foreign trade. Repressive measures adopted in Pennsylvania are as follows: Mr. Thomas J. Edge, Secretary of the Pennsylvania State Board of Agriculture, after citing the history of the disease in Europe and in this country, and alluding to its long presence in Pennsylvania in a malignant and destructive form, states that finally, but not until after the farmers of the State had sustained heavy losses, a meeting of the dairymen of Delaware, Montgomery, and adjoining counties was called. This meeting was held in Philadelphia soon after and before its adjournment a committee was appointed to wait upon the secretary of the board of agriculture and urge the importance of legislative action. The veterinary surgeon of the board, in company with this committee visited herds supposed to be infected. Surgeons who had had years of experience with the disease in Europe and elsewhere were also called in; *post mortem* examinations were made, and the existence of the malady established beyond a doubt. The legislature being in session, the secretary of the board laid all the evidence before the joint committee of agriculture, and, after discussion and mature consideration, it was decided that the State should adopt a line of precautionary and preventive action, not only for the benefit of its own citizens, but also out of respect to the action of adjoining States. A sub-committee was, therefore appointed to consult with the governor and, if deemed expedient, they were instructed to draft an act providing for the suppression of the disease. After consultation, the following resolution was offered and adopted by both branches of the legislature:

Whereas, The States of New York and New Jersey, by recently enacted laws to prevent the dissemination among live stock of the disease known as pleuro-pneumonia, now invite this State, by a concert of action, to assist them to eradicate this contagion: Therefore, Resolved by the Senate (if the House of Representatives concur), that the governor be, and he is hereby, authorized to take such preliminary action as may be necessary to prevent its further spread.

This resolution was approved by the governor March 27, 1879. At the same time, an act previously adopted by the committee was introduced, which, after amendment, passed both branches of the legislature. The law of New York, approved by Gov. Hoyt, May 1, 1879, and entitled, an act to prevent the spread of contagious or infectious pleuro-pneumonia among the cattle in this State, is as follows:

Sec. 1. Be it enacted, etc., That whenever it shall be brought to the notice of the governor of this State that the disease known as contagious or infectious pleuro-pneumonia exists among the cattle in any of the counties in this State, it shall be his duty to take measures to promptly suppress the disease and prevent it from spreading.

Sec. 2. That for such purpose the governor shall have power, and he is hereby authorized, to issue his proclamation, stating that the said infectious or contagious disease exists in any county or counties of the State, and warning all persons to seclude all animals in their possession that are affected with such disease, or have been exposed to the infection or contagion thereof, and ordering all persons to take such precautions against the spreading of such disease as the nature thereof may, in his judgment, render necessary or expedient; to order that any premises, farm, or farms where such disease exists or has existed be put in quarantine, so that no domestic animal be removed from said places so quarantined, and to prescribe such regulations as he may judge necessary or expedient to prevent infection or contagion being communicated in any way from the places so quarantined; to call upon all sheriffs and deputy sheriffs to carry out and enforce the provisions of such proclamations, orders, and regulations, and it shall be the duty of all the sheriffs and deputy sheriffs to obey and observe all orders and instructions which they may receive from the governor in the premises; to employ such and so many medical and veterinary practitioners and such other persons as he may, from time to time, deem necessary to assist him in performing his duty as set forth in the first section of this act, and to fix their compensation; to order all or any animals coming into the State to be detained at any place or places for the purpose of inspection and examination; to prescribe regulations for the destruction of animals affected with the said infectious or contagious disease, and for the proper disposition of their hides and carcases, and of all objects which might convey infection or contagion (provided that no animals shall be destroyed unless first examined by a medical or veterinary practitioner in the employ of the governor aforesaid); to prescribe regulations for the disinfection of all premises, buildings, and railway-cars, and of objects from or by which infection or contagion may take place or be conveyed; to alter and modify, from time to time, as he may deem expedient, the terms of all such proclamations, orders and regulations, and to cancel or withdraw the same at any time.

Sec. 3. That all the necessary expenses incurred under the direction, or by authority, of the governor in carrying out the provisions of this act shall be paid by the treasurer, upon the warrant of the auditor-general, on being certified as correct by the governor: Provided, that animals coming from a neighboring State that have passed a veterinary examination in said State, and have been quarantined and discharged, shall not be subject to the provisions of this act.

Under authority of the act before quoted, and based upon the report of the commission, his excellency Governor Hoyt appointed a special agent to take charge of the matter, under a special commission, as follows: It having been ascertained that an infectious and contagious disease of neat cattle, known as pleuro-pneumonia, has been brought into and exists in certain counties of this State, I hereby appoint you as my assistant to carry out the provisions of the acts of 1866 and 1879, for the prevention of the spread of this disease. As such assistant you are hereby authorized—To prohibit the movement of cattle within the infected districts, except on license from yourself, after skilled veterinary examination under your direction. To order all owners of cattle, their agents, employés, or servants, and all veterinary surgeons, to report forthwith to you all cases of disease by them suspected to be contagious; and when such notification is received you are directed to have the case examined, and to cause such animals as are found to be infected with said disease to be quarantined, as also all cattle which have been exposed to the infection or contagion of said disease, or are located in any infected district, but you may, in your discretion, permit such animals to be slaughtered on the premises and the carcases to be disposed of as meat if, upon examination, they shall be found fit for such use. You may prohibit and prevent all persons not employed in the care of cattle therein kept from entering any infected premises. You may likewise prevent all persons so employed in the care of animals from going into stables, yards, or premises where cattle are kept, other than those in which they are employed. You may cause all clothing of persons engaged in the care, slaughtering, or rendering of diseased or exposed animals or in any employment which brings them in contact with such diseased animals, to be disinfected before they leave the premises where such animals are kept. You may prevent the manure, forage, and litter upon infected premises from being removed therefrom; and you may cause such disposition to be made thereof as will, in your judgment, best prevent the spread of the disease. You may cause the buildings, yards, and premises in which the disease exists, or has existed, to be thoroughly disinfected. You are further directed, whenever the slaughter of diseased animals is found necessary, to certify the value of the animal or animals so slaughtered, at the time of slaughter, taking into account their condition and circumstances, and to deliver to their owner or owners, when requested, a duplicate of such certificate. Whenever any owner of such cattle, or his agent or servant, has willfully or knowingly withheld, or allowed to be withheld, notice of the existence of said disease upon his premises, or among his cattle, you will not make such certificate. You are also directed to take such measures as you may deem necessary to disinfect all cars or vehicles or movable articles by which contagion is likely to be transmitted. You will also take such measures as shall insure the registry of cattle introduced into any premises on which said disease has existed, and to keep such cattle under supervision for a period of three months after the removal of the diseased animal and the subsequent disinfection of said premises. You are further authorized and empowered to incur such expenses in carrying out the provisions of the foregoing orders as may, in your judgment, appear necessary, and see to it that all bills for such expenses be transmitted to this department only through yourself, after you have approved the same in writing. [The editor considers it proper to state, in this connection, that the importance of repressive measures for the stamping out of the disease (and the impossibility of doing this, once it is distributed in the West), has caused him to collate largely on the subject of Pleuro-pneumonia]. In relation to preventive treatment, and for disinfection, Dr. Law, in his Veterinary Adviser, recommends the following, as instructions for the stables, etc. For stables instructions may embrace what follows: 1. Remove all litter, manure, feed and fodder, from the stables; scrape the walls and floor; wash them if necessary, remove all rotten wood.—2. For buildings take chloride of lime one-half lb., crude carbolic acid four oz., and water one gallon; add freshly-burned quicklime till thick enough to make a good whitewash; whitewash with this the whole roof, walls, floors, posts, mangers, drains, and other fixtures in the cow stables.—3. Wash so as to thoroughly cleanse all pails, buckets, stools, forks, shovels, brooms, and other movable articles used in the buildings, then wet them all over with a solution of carbolic acid one-half lb., water one gallon.—4. When the empty building has been cleansed and disinfected as above, close the doors and windows, place in the center of the building a metallic dish holding one lb. flowers of sulphur; set fire to this and let the cow shed stand closed and filled with the fumes for at least two hours. The above should suffice for a close stable capable of holding twelve cows. For larger or very open buildings more will be required.—5. The manure from a stable where sick cattle have been kept must be turned over and mixed with quicklime, two bushels to every load; then hauled by horses to fields to which no cattle have access, and at once plowed under by horses.—6. The pits, where the manure has been, must be cleansed and washed with the disinfectant fluid as for buildings, (see 2).—7. The surviving herd should be shut up in a close building for half an hour once or twice a day, and made to breathe the fumes of burning sulphur. Close doors and windows, place a piece of paper on a clean shovel, lay a few pinches of flowers of sulphur upon it, and set it on fire, adding more sulphur, pinch by pinch, as long as the cattle can stand it without coughing. Continue for a month.—8. Give two drachms powdered copperas, green vitriol, daily to each cow in meal or grains; or, divide one pound copperas into fifty powders, and give one daily to each adult animal.—9. Do not use for the surviving cattle any feed, fodder nor litter that has been in the same stable with the sick. They may safely be used for horses and sheep. In certain cases further measures are needed, as removal of the flooring and soil beneath, or even the burning of the entire structure. Drains must also be cleansed.

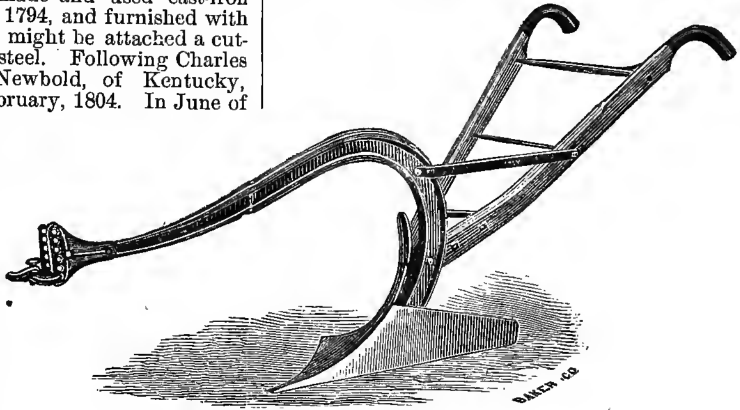
PLICIPENNATES, PLICIPENNES. Neuropterous insects, the inferior wings of many of which are larger than the upper pair, and are folded lengthwise, as the caddis flies.

PLINTH. The lowest form or member of the base of a column, of a square figure and small height.

PLIOCENE. The uppermost portion of the tertiary formation, containing recent fossils, for the most part.

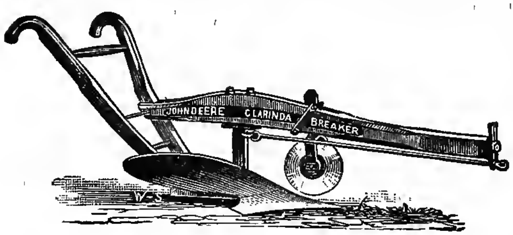
PLOTTING. In surveying, laying down on paper the angles and lines measured to calculate the contents of a given tract; it is done with a protracter or plotting scale.

PLOW. That the plow is the most important implement of tillage, is beyond question. Notwithstanding that we have historical evidence in the Book of Job (probably the most ancient of biblical writings) that the plow was used in his day, and through successive generations and centuries, evidence of its use until we come down to the time of the enlightened Grecian and Roman periods, the crude implement of Abraham, undoubtedly of Egyptian, if not of Chinese origin, was but little improved. An implement originally a fire hardened, pointed share, with a handle and beam for draft. In the article Agriculture will be found cuts of these most ancient implements. Notwithstanding the great antiquity of the plow, but little real improvement was made over the form of the Roman plow until within the last two hundred years, and like the history of all great inventions, the last forty years have witnessed the greatest practical improvement, in ease of draft, certainty in turning correct furrows, according to the nature of the soil; in deep tillage and the various conditions desired in culture, and, most important of all, the certainty of a surface to the metallic parts that shall scour and retain their polish even in the most adhesive soils, some of which, in the West, long baffled the practical science of our best inventors East and West. To show something of the state of plows and plowing in England in the last century, Adam Dickson, in his voluminous work on agriculture, in the early part of the century, speaking of the plows of the ancients, says: It is probable that I shall be considered as very partial to the ancients, if I do not allow the moderns to excel them in the construction of their plows. We are not, indeed, so well acquainted with the ancient plows as to make a just comparison. I shall only observe, that from the few passages in the rustic authors concerning them, it appears that the ancients had all the different kinds of plows that we have now in Europe, though not perhaps so exactly constructed. They had plows without mold-boards and plows with mold-boards; they had plows with coulters and plows without coulters; they had plows with wheels and plows without wheels; they had broad-pointed shares and narrow-pointed shares; they even had what I have not yet seen among the moderns, shares not only with sharp sides and points, but also with high raised cutting tops. Were we well acquainted with the construction of all these, perhaps it would be found that the improvements made by the moderns in this implement are not great as many persons are apt to imagine. While Mr. Dickson probably estimated the skill of the ancient plowmakers from the classical stand point of a scholar, he was certainly correct in a sense as compared with the plows in common use, just as we to-day, while every neighborhood contains plows adapted to every variety of work, nevertheless see the majority of small farmers using one plow for all work, and that perhaps not of the best pattern. Yet in England in Mr. Dickson's time, there were, it is probable, plows far superior to any the ancients ever used; for it is not to be supposed they would depict their inferior implements and leave unpictured the superior ones. So far as we of the present day are informed the plows of the ancients, and also of the moderns, for the first thousand years after Christ, and indeed up to nearly the eighteenth century, were of the rudest description, hardly two alike. The beams cumbrous, and, as were the handles, hewed from the branches of trees, the mold-boards and landsides and the shares even of wood, simply strapped and pointed with iron at the principal wearing points. Indeed we have ourselves seen within the last forty years, and have used for breaking prairie in Cook county, Ill., a plow but little better than this. The celebrated Daniel Webster plow, exhibited at our Centennial Exposition at Philadelphia, and which he helped to make and used, was mostly of wood, an uncouth, cumbrous implement requiring the force of several yokes of oxen to move. This plow might as well have left the impression of the improved plow of that day. It was made for a special purpose, to work among grubs and stones, and undoubtedly performed its work tolerably well. To-day, we have plows that with three horses will do more and better work than did this Leviathan of plows drawn by five or six yokes of oxen. As showing the improvements in progress in England, during the latter part of the eighteenth century, and the development of the draft rod, Small's chain plow was a notable improvement. The plow, as improved by Small, has since become celebrated by subsequent improvements, as the East Lothian plow. Taking up now the history of plows in America, Mr. A. B. Allen, in the Report of the New York State Agricultural Society for 1856, describes the plowmaker's art, in the early part of the century, in the United States, as follows: A winding tree was cut down, and a mold-board hewed from it, with the grain of the timber running so nearly along its shape as it could well be obtained. On to this mold-board, to prevent its wearing out too rapidly, were nailed the blade of an old hoe, thin straps of iron, or worn-out horse shoes. The land side was of wood, its base and sides shod with thin plates of iron. The share was of iron, with a hardened steel point. The coulter was tolerably well made of iron, steel edged, and locked into the share nearly as it does in the improved lock coulter plow of the present day. The beam was usually a straight stick. The handles, like the mold-board, split from the crooked trunk of a tree, or as often cut from its branches; the crooked roots of the white ash were the most favorite timber for plow handles in the Northern States. The beam was set at any pitch that fancy might dictate, with the handles fastened on almost at right angles with it, leaving the plowman little control over his implement, which did its work in a very slow and imperfect manner. Curious, is is not, that the same idea prevailed among the primitive American husbandmen, in the year 1800, that instigated the primitive husbandmen of 3,000 years previous, a crotched limb, natural crooks, roughly hewed, and the addition of bits of iron roughly fastened to the wearing points. To the scientific mind of Jefferson are we indebted for the first demonstration of the true principles upon which the plow should be constructed. Traveling in France and Germany in the year 1788, his spirit of observation led him frequently to alight and examine the working implements of the farmers there. Surprised at the uncouth forms of their plows and harness, at Nancy, the capital of ancient Lorraine, he made the following entry in his journal: Oxen plow here with collars and hames. The awkward figure of their mold-boards leads one to consider what should be its form. The offices of the mold-board are to receive the sod after the share has cut under it, to raise it gradually and to reverse it. The fore end of it should, therefore, be horizontal, to enter under the sod, and the hind end perpendicular, to throw it over; the intermediate surface changing gradually from the horizontal to the perpendicular. It should be as wide as the furrow, and of a length suited to the construction of the plow. Returning home, when secretary of state, under Washington's Administration, he consulted the celebrated David Rittenhouse, as to whether his plan was founded upon correct mathematical principles. After a careful examination it was decided to be demonstrated. In 1793, this theory of Jefferson's was reduced to practice. Some years after, the discovery of Jefferson was contested by William Amas. This was in 1808. Mr. Jefferson presented his ideas to the French Academy, and to the English Board of Agriculture, who having ample means of testing any imposture, acknowledged the invention of Jefferson, and he was subsequently elected an honorary member of the board. Jefferson, who experimented with the mold-board of the plow only, states his conclusions to be that the mold-board of the plow ought not only to be the continuation of the shield of the share beginning at its posterior edge, but it must also be in the same plane. Its first function is to receive horizontally from the sock the earth, to raise it to the height proper for being turned over; to present, in its passage, the least possible resistance, and consequently to require the minimum of moving power. Were its function confined to this, the wedge would present, no doubt, the most proper form for practice; but the object is also to turn over the sod of earth. One of the edges of the mold-board ought then to have no elevation, to avoid a useless wasting of force; the other edge ought, on the contrary, to go on ascending until it has passed the perpendicular, in order that the sod may be inverted by its own weight; and the inclination of the mold-board must increase gradually from the moment that it has received the sod. In this second function the mold-board then acts like a wedge situated in an oblique direction, or ascending, the point of which recedes horizontally on the earth, while the other end continues to rise till it passes the perpendicular. Or, to consider it under another point of view, let us place on the ground a wedge, the breadth of which is equal to that of the share of the plow, and which in length is equal to the share from the wing to the posterior extremity, and the height of the heel is equal to the height of the rear of the share above the sole; draw a diagonal on the upper surface from the left angle of the point to the angle on the right of the upper part of the heel; slope the face by making it bevel from the diagonal to the right edge which touches the earth; this half will be the most proper form for discharging the required functions, namely, to remove and turn over gradually the sod, and with the least force possible. If the left of the diagonal be sloped in the same manner, that is to say, if we suppose a straight line, the length of which is equal at least to that of the wedge, applied on the face already sloped, and moving backwards parallel to itself and to the two ends of the wedge, at the same time that its lower end keeps itself always along the lower end of the right face, the result will be a curved surface, the essential character of which is, that it will be a combination of the principle of the wedge, considered according to two directions, which cross each other, and will give what we require, a mold-board presenting the least possible resistance. This mold-board, besides, is attended with the valuable advantage that it can be made by any common workman by a process so exact that its form will not vary the thickness of a hair. One of the great faults of this essential part of the plow is the want of precision, because workmen having no other guide than the eye, scarcely two of them were constructed alike. Following Jefferson, Charles Newbold, of New Jersey, obtained a patent in 1797, said to be the first cast plow ever made in America. The idea of Newbold, as stated in his specifications, was to cast the plow, except the handles and beam, in one piece, consisting of a bar, sheath, and mold-plate, the sheath serving also for a coulter, and the mold-board serving also for the share. Previous to this cast-iron plow shares were used. Col. John Smith, of St. George's Manor, Suffolk county, N. Y., had made and used cast-iron plow shares as early as 1794, and furnished with a false edge, to which might be attached a cutting edge of iron or steel. Following Charles Newbold, Hezekiah Newbold, of Kentucky, patented a plow in February, 1804. In June of the same year, John Denver patented another. In 1807 a patent was granted to David Peacock for a plow, and this ended in a lawsuit, as an infringement on the Newbold patent. The special new feature was the lock coulter. The patents as recorded, succeeding are as follows, so far as is known: Hezekiah Harris, Ky., patent in 1808, and in the same year a patent to Richard B. Chenoweth, of Maryland. Then follows John Klay, of the same State, January 11, 1812. On the same day a patent was granted to Roswell Tousley, subsequently a partner of Jethro Wood, who took out his first patent in 1814, but to which he seems not to have attached much value. Then follows Mathew Patrick, New York, patent January 2, 1813; John Seltz, February 8, 1813; Horace Pease, New York, August 28, 1813. In 1814, besides the patent to Jethro Wood, there were patents granted to John Swaa, New York, J. Morgan and J. B. Harris; and to David Peacock, of New York, in 1817. In 1818, Gideon Davis is recorded as taking a patent for the first plow built on mathematical principles since the days of Jefferson. This plow was really a step ahead, as will be seen by the following extract from his specifications, in which he says: The great desideratum to be attained in the box share or shallow plow, is that it be so shaped and constructed as to detach the furrow slice from the solid ground, raise it up and turn it over, in the neatest and most uniform and effectual manner, with the least possible labor, both to the plowman and the team, combining at the same time the advantages of being simple in its structure, strong and durable, easy to keep in repair, and cheap. The mode of using, it is desirable, should be such as will cause the least trouble and inconvenience to the plowman. With a view to combine, as far as practicable, these various objects, he began by making the mold-board, land side, and standard, (or width for the beam to rest on,) all of cast-iron, and in a solid piece; this is done in the manner that Charles Newbold, of New Jersey, made his improved plow, patented in the year 1797, but with several alterations and improvements hereinafter particularly specified. Of the shape of the molding part, or what is commonly called the face of the mold-board, the general principle heretofore concurred in by all scientific men who have turned their attention to this subject, is that the furrow slice is detached from the solid ground, at a straight line, parallel to the surface, at such depth as may be required, that it should be raised up and turned over, so as to retain, as far as possible, the same flat shape. In order to accommodate the face of the mold-board to this idea of raising the furrow slice up and turning it over, it has been so constructed as to form straight lines lengthwise, either horizontal or a little inclined, and also to correspond with another set of straight lines at right angles with the land side, or nearly so, commencing at the point touching the edge of the share and lower edge of the mold-board. These last mentioned straight lines, as they recede from the point of the commencement, gradually change from a horizontal or a perpendicular direction, and even pass beyond the perpendicular so far as to give the proper over-jet behind. It had been thought that mold-boards so constructed would fit and embrace every part of the furrow slice in the operation of turning it over, not observing that the furrow slice must necessarily assume a convex form on the under side during the operation by which it is raised up and turned over. The truth is, however, that in raising and turning over the furrow slice it always acquires a convex form on the under side, or else it is broken into pieces and thrown over; as might therefore be anticipated, it will be found that all those

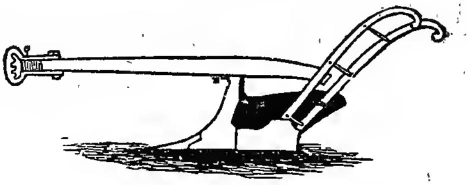


DEEP TILLER, STEEL BEAM.

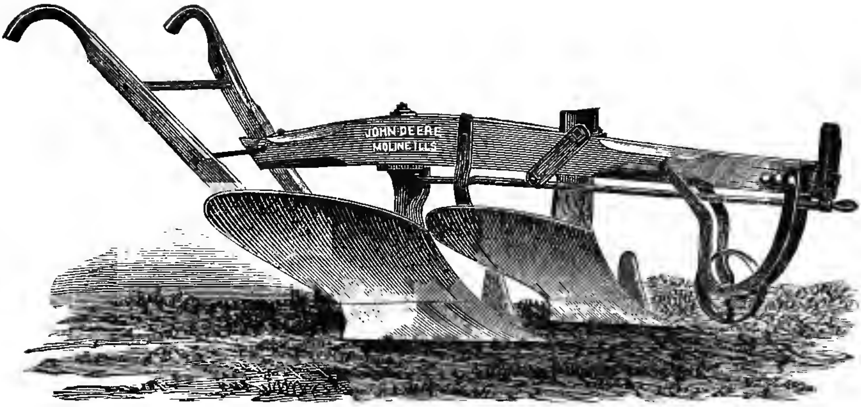
mold-boards which are constructed on this principle wear through, in the operation of plowing, about midway, whilst the upper and lower edges are scarcely rubbed. It also necessarily results that plows of this description work hard and also are of heavy draft, because the mold-board, not being adapted to the convex form which the furrow slice is disposed to assume, lifts the furrow slice at a single point, and that in the middle, instead of being equally applied throughout the entire operation. In order to meet and remedy the inconveniences arising from this form of structure, the mold-board was formed into a different shape, and instead of working the molding part or face of the mold-board to straight lines, the improvement was to work it to circular or sphere lines. Pickering, Hitchcock, Nourse, McCormick, and Knox were also careful laborers subsequently in the same field of invention, and extending the time to the year 1850. About the time of the Knox patent, Joshua Gibbs, of Canton, O., while plowing, observed the unequal wear on the plowshare. Selecting a block of wood, he fashioned it as nearly as possible to his idea of a correct mold-board, attached it to a beam and handles, plowed with it stopping now and then to hew away with his adze that part of the mold-board which he found scoured most by the soil. By successive trials, he obtained a wooden mold-board all parts of which presented equal resistance to the soil in its forward movement. August 15th, 1854, he obtained a patent for his mold-board. He thus describes it in his specifications: The working surface of the mold-board consists of about one-fourth of the interior surface of a hollow cylinder. If the plow is intended to turn a surface six inches wide, a mold-board made from a cylinder with about a twelve-inch bore is desirable; but if it is intended to turn a furrow twelve inches wide, the mold-board should be made from a cylinder with a bore of about twenty-four inches; as these plows have been found to work best when they turn a furrow about as wide as the radius of the bore of the cylinder from which the mold-board was made. It has been found from experience that these plows work best when the length of the mold-board is from one and a half to twice the diameter of the bore of the cylinder from which the mold-board is made. The advantages claimed were: 1. The plow draws easier. 2. It raises the furrow from the point and share more generally, naturally, and easily, turns and lays the furrow more uniform, smooth, and even, than any other mold-board, and leaves the trench wider in proportion to the width of the plow, and consequently the rear of the plow need not be set so wide as when a different mold-board is used. 3. It breaks the sward or furrow far less than any other. 4. The mold board, being more arched is stiffer and stronger than others of the same size and weight; and, making the working surface of the mold-board in the form of a section of a hollow cylinder; the center or axis of the cylinder being parallel or nearly parallel horizontally to the base of the mold-board, substantially as described. We now return to Jethro Wood, whose name will always be remembered for his improvements in the manner of casting and fitting the working parts of plows. In 1819, his ideas were matured on the subject of plows, and from the views then set forth in his specifications for the patent then issued to him, he never deviated. The illustration we give, an accurate copy deposited by him in the Patent Office, will explain itself by means of the lines. The figure of the mold-board being, he says, as observed from the furrow side, a sort of irregular pentagon, or fine sided plane, though curved and inclined in a peculiar manner. While Mr. Wood did not add materially to the working value of the plow, he did perform this inestimable service. Before he perfected his inventions, plows were huge, uncouth, and clumsy, costly in the repairs needed, and did not perform good work. Mr. Wood did lighten the weight of the plow, and made a better plow, that cost less money than the others. Coming to the year 1840, the Messrs. Ruggles, Nourse, and Mason, commenced improving the cast plow, through the patient experiments of Mr. Nourse. In 1842, the Eagle plow No. 2, was produced. In 1845, Gov. Holbrook, of Vermont, interested himself with Mr. Nourse, devising a system by which the lines of the mold-board, if the longitudinal ones are carefully laid on the pattern, the vertical ones will be certain to be correct. Since 1850, the great point in improving plows has been rather in the matter of detail, in adapting them to every variety of soil, and every purpose imaginable, and also to the invention of plow fixtures of various kinds. It is said that plows of over 1,200 different patterns are now made and adapted to every conceivable work, including trench plowing, subsoiling, ditching, road making, and excavating great ditches and canals, by means of attachments to plows of peculiar shapes. (See article Road-making.) The East, years ago, had their plows well adapted to the work required of them. In the average soil there the cast-iron plow would scour perfectly. The Nourse, the Holbrook, the Colins, cast cast-steel and other steel plows, were quite satisfactory in more adhesive soils. With the settlement of the great West, and the failure of Eastern plows to scour in peculiar humus prairie soils, wonderfully light and porous, and yet with scarcely any apparent grit, great difficulty was experienced. This early led many inventive minds, even forty years ago, toward devising a mold-board that would cast



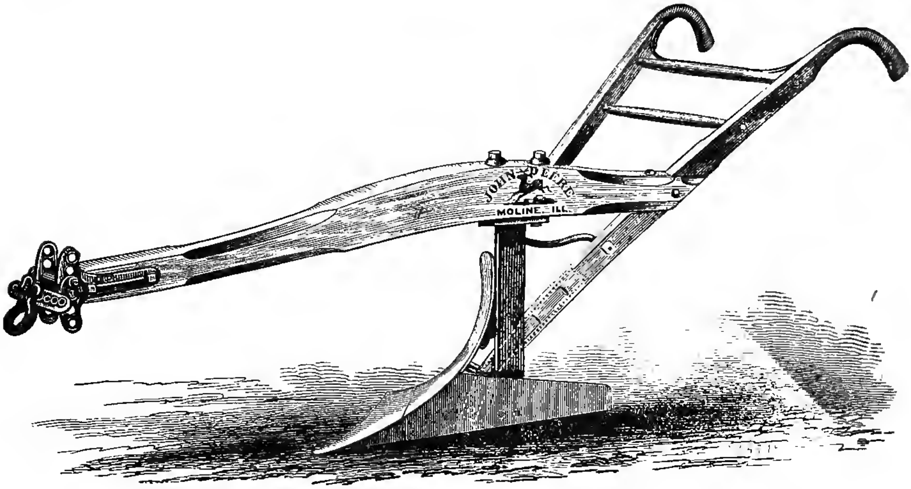
BREAKER, ROLLING COULTER.



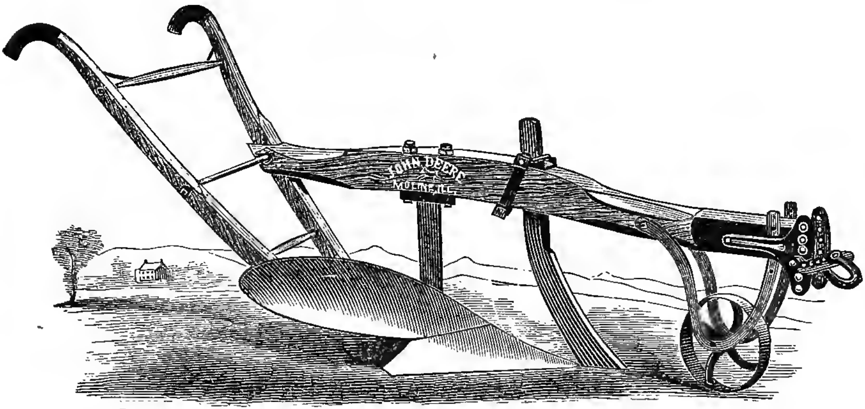
THE FIRST CAST-IRON PLOW.



MICHIGAN DOUBLE PLOW.



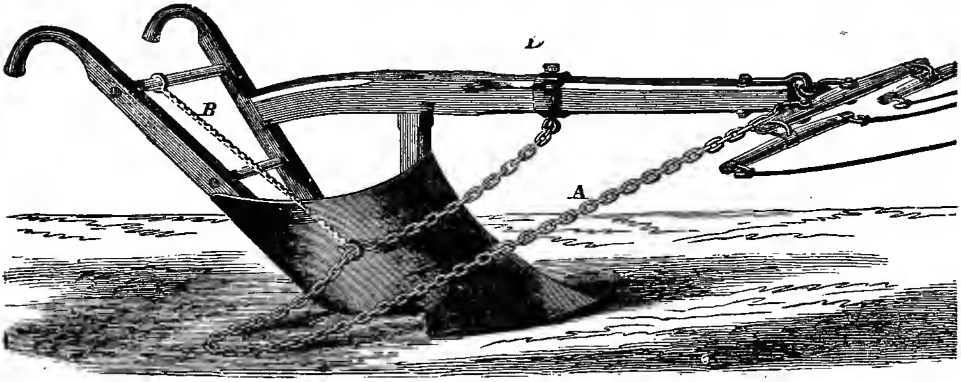
DEEP TILLER, WOODEN BEAM.



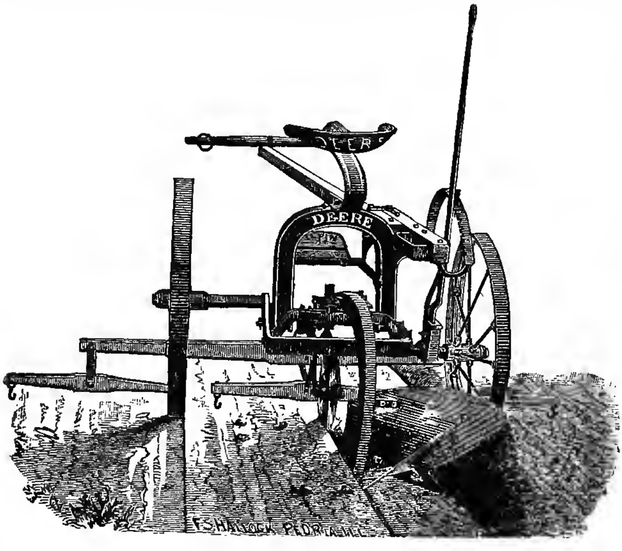
BAKER-CO

PRAIRIE BREAKER, KNIFE COULTER.

off the peculiar and sticky muck of many Western prairie soils. Mr. John Deere, the elder, of Moline, experimented with steel saw plates and realized a fair measure of success, which later resulted in the building of plows entirely of fine or what is now known as plow steel, at least so far as the surfaces which come in contact with the earth is concerned. Now these highly polished steel plows are made for every variety of soil, and for every variety of work, leaving only one thing more to be desired, an implement that shall perform the labor, at a less expenditure of draft, and pulverize the soil in a better manner than the plow. This has been successfully accomplished, by means of rotary implements, when simply the stirring of the soil is necessary. What the future has in store in this direction remains for future inventors to solve.



CHAIN FOR COVERING UNDER WEEDS.



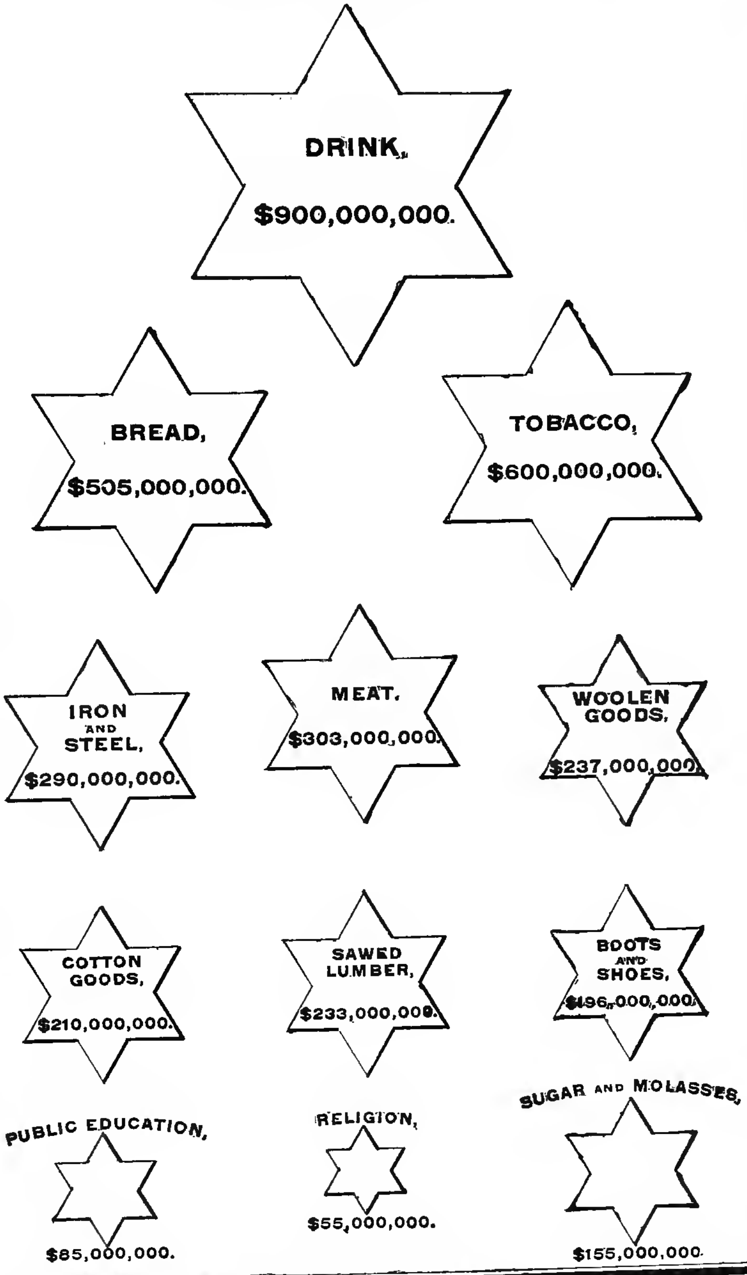
RIDING PLOW.

As illustrating the various forms of plows we have interspersed a series of cuts of plows as designed for various tillage, and which will sufficiently explain themselves. Within the last few years an important modification of the handling of plows has been inaugurated, which while not materially lightening the draft, enables the cut of the plow to be widened, as it certainly does cut a more equable furrow, than the swing plow, or in lieu of this, allows two plows to be ganged together, either plowing two furrows along side the other, or throwing one furrow directly on the other. The idea will readily be caught from the engraving of a three-horse plow turning a sixteen inch furrow. This class of plows are increasing in popularity year by year, the only objection to them being the increased cost over that of the ordinary swing plow. In the article Plowing will be given much additional matter in reference to plows and plowing, with cuts illustrating, both horse and steam plowing. (See also articles Cultivators and Stirring the Soil.)

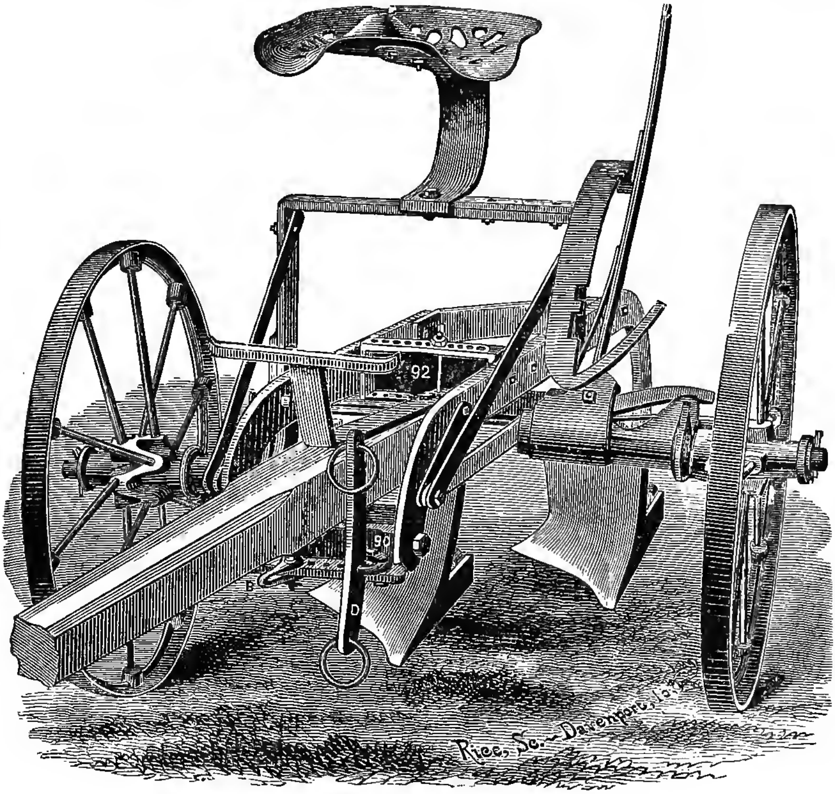
PLOWING. In plowing, the object sought is to turn the soil in such manner as may adapt it to be most easily brought to that state best required for a crop, under the various conditions of prairie sod, second sod, green sward, grubby timber land, weedy fields, stubble; or, land, fallow or otherwise, but which may be covered with a green crop more or less heavy, and which is required to be turned under in such a way as to completely cover the trash, thus causing it to be freely brought into a state of decomposition. These states may now be all fully and perfectly accomplished by some one of the many plows made East and West, and specifically adapted to the end in view. Eastern made plows doing fully as well in Eastern soils as do Western made plows in the peculiar soils of our prairie States. Some years since the State Agricultural Society of New York offered handsome premiums for plows doing the best work in a variety of soils, and combinations, including turf, stubble, deep, trench, subsoil and other plowing. The Hon. J. Stanton Gould was chairman of the committee on plows and plowing, which committee included others of the most eminent practical men in the State. The most able, exhaustive, and elaborate report of this committee covers

WHAT WE SPEND OUR MONEY FOR.

THE NECESSARIES OF LIFE, COMPARED WITH THE COST OF LIQUOR AND TOBACCO.

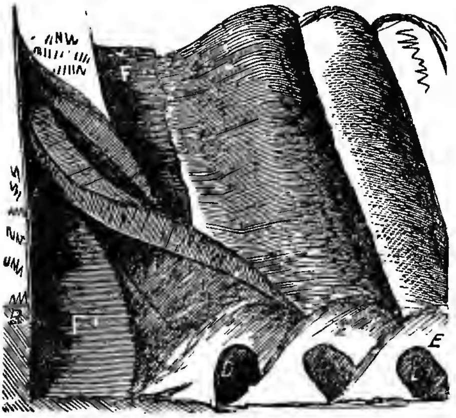


the whole ground of plows and plowing, and from the interest and importance of the subject, we extract portions pertinent to this article, which will be well worth the study of all, not excepting that large class who call themselves good plowmen; for it must be confessed that very few who consider themselves entitled to the best farm wages going, not only have never studied the rationale of plowing, but have really given but little attention as to whether the plow was only doing medium or strictly good work. Another class, never keep their furrows straight, and in fact can not drive a somewhat wild team straight across a forty-acre field, and of course can not make their furrows come out equal at the close of the land. In the extracts we give we shall exclude everything pertaining to the scientific elucidation of the subject, for, at this day plows are made for every variety of work so that all that the individual has to do is to state to the plow-making firm just what is expected to be performed and, the proper plow will be selected and sent out of the variety of materials in store. That is it should be stated whether flat or lap furrows are to be laid in sod, or whether the plow is intended for stirring the soil, turning under trash, for shallow plowing or deep tillage, and also, whether for skim and trench plowing, one plow following another. To illustrate: The plow for prairie sod, when the slice turned is to be as thin as possible is of an entirely different form from that where a deep furrow is to be turned; deep furrows being lapped one on another, as in plowing clover, and other meadow sward. Again, the curve of the mold-board must be different, when one strip of sod is to fit in closely along another, furrow for furrow. So again in trench plowing with the Michigan double plow, the thin skim furrow is often rolled up forming a scroll, or spiral of sod under the soil thrown on top. (See article Plow for illustrations of plows.) In plowing under trash various devices are used, called weed hooks, coulter cleaners, etc. The most common plan is to hitch a chain to the plow the loop to drag in the furrow as shown on page 744. Difficulty is sometimes experienced in getting the chain to work properly, this, however, can readily be arranged to suit the particular circumstances. Neither the chain nor weed hook, however, will work unless the crop to be turned under is of considerable length so the implement can guide the tops in the proper direction to be covered under. In trench plowing especially where it is deep, the lower slice, which covers the skim furrow, must always be more or less crowded or pushed up, so the work will be as shown in the cut on next page; D, showing the position of the under slice, E, the covering furrow slice and F, F, the furrows; the curve of the furrow slices are shown between E, E, and D, D, D. The Michigan double plow is now but little used, since riding plows have come into use. The two plows are now attached to one beam as shown in the cut, double or trench plow.

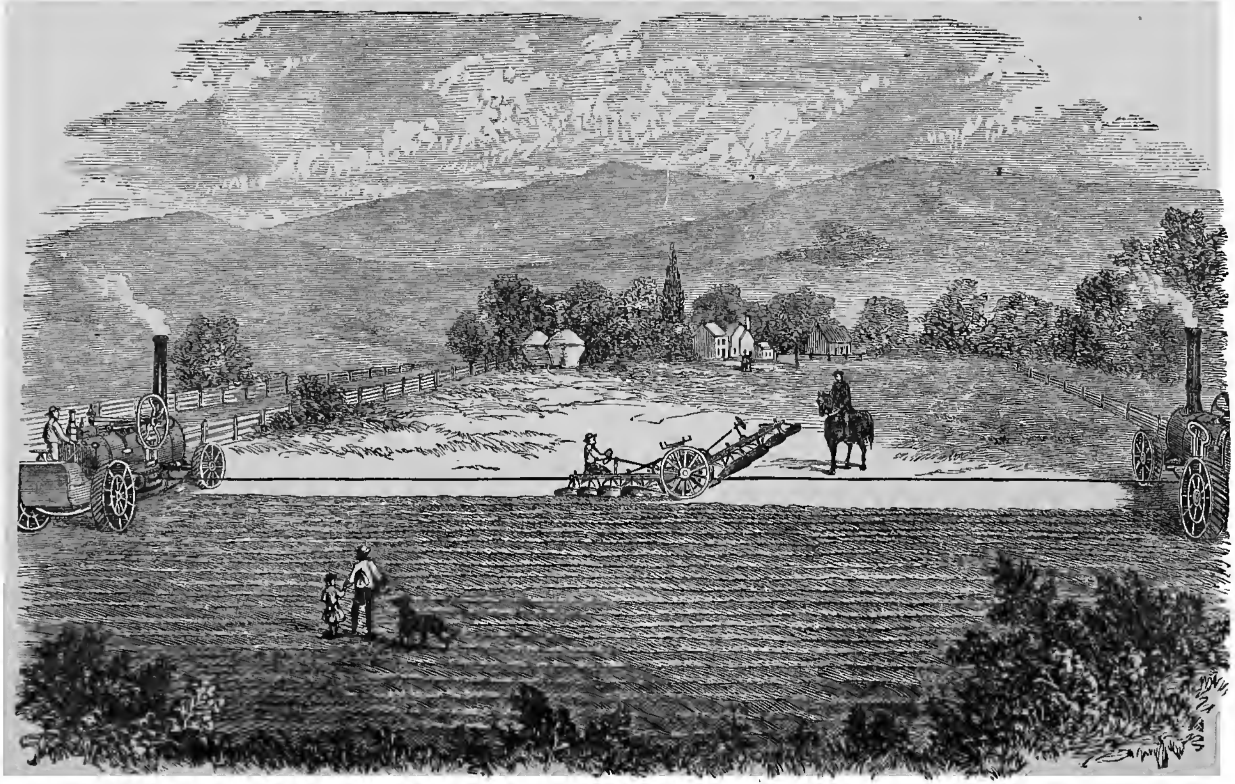


DOUBLE OR TRENCH PLOW.

These are now made of a draft so light that four horses work them easily. With the Michigan double plow the draft is very much more severe. Plowing by steam has never been economically accomplished in the United States. It is not by any means that the plowing is not superior of its kind, especially when extra deep plowing is required, as has been attested in the sugar fields of Louisiana, and in various trials in the West, by the various traction engines that have been invented. The difficulty with all traction engines has been, that on soft soil, they would mire themselves, or else the sticky nature of the soil would at times clog them. Another difficulty is the trouble in obtaining skilled engineers in the country, and the expense of hauling fuel and water to feed the engines. Again if they get out of repair, ordinary country blacksmiths can not repair them. On the other hand our two-furrow gang plows do operate successfully and evenly, and are much employed on large farms and upon the great wheat fields of the far Northwest. As illustrating steam gang-plowing as against horse gang-plowing, we give two illustrations, showing the English system of steam plowing, and the American system of horse plowing. The reader will readily see why, in ordinary plowing, the American system is the cheapest. The writer has superintended the working of twenty single swing plows, turning twenty furrows, with twenty men and sixty horses, or three horses to each plow, the plows cutting fourteen inches each. The daily average work of the gang, on lands running across a section, of 640 acres, was one-third of an acre per hour, or three acres per team per day, or an aggregate of sixty acres a day. Few plowmen understand the necessity of a nice adjustment of the plow to the work in hand; bolts are lost, nuts get loose, and the plow is still driven, they being content with such work as it will do. If it be a plow in which a coulter is used, feeble attempts are made to remedy the evil by giving the coulter a twist out of line, or altering the set of the clevis, when the real fault lies in a proper adjustment of the beam. A plow, when properly adjusted, in a soil free from roots and stones, will swim along almost without the aid of the plowman. The same plow not properly adjusted, can scarcely be made to work at all. Again, the good plowman will feel at once the slightest deviation in a plow from the true course, and a slight change keeps the plow in its proper course. So we see that lightness and delicacy of touch is by no means a useless accomplishment in the plowman. It is of as much consequence as that he have a correct eye, that the furrow slices be straight, and of uniform width and thickness, and turned so the plowed surface shall be disintegrated and level, or left rough as occasion may require. Yet, how many plowmen really pay attention to these details? How many, in fact, know really good plowing from indifferent plowing. It is to be regretted that competitive trials by expert plowmen should have gone out of fashion. They were of great value as object lessons to the masses who attended. At least the master of the farm might here compare results and get many valuable lessons to be communicated to the farm hands, and knowing just what good work consisted in, it might be insisted that the work should be so done. For the object in all matches of this kind should be to award the premium to the plowman leaving the best surface finish, with proper pulverization, according to the width and depth of furrow. As an aid in estimating the work to be done by a plow we give an elaborate and highly valuable table on page 749, showing the distance traveled by the team in plowing an acre, in connection with the width of furrow slice in inches and the extent plowed per day, the team traveling respectively eighteen and sixteen miles, working nine hours per day. The rationale of plowing may be stated as follows: A soil in a finely pulverized state holds more moisture—hydroscopic water—than when in a solid state. A single experiment will show this. A field plowed in the fall will retain a larger amount of moisture in the spring than if it were left unplowed. Finely pulverized soil when in a dry state takes up moisture equally from the air, and with it large quantities of nitrogen compounds. Thus porous soils, because cool, are constantly condensing water during droughts, and hold the constituents it contains to be taken up by the rootlets, and assimilated by plants. Soils thoroughly underdrained, when allowed to rest, become honey-combed by insects to the water line occupied by the drains, and hence these serve as channels to quickly conduct the rain which falls immediately away. This, however, is not what is wanted, for thus the fertilizing properties in rain water do not come intimately in contact with the soil, and are lost; thus the error into which certain superficial experimenters have been led, in supposing that drained lands would not stand drought. If the surface soil were pulverized to a depth of from six to ten inches or more, the case would be very different. It would then act as a filter, passing the water off more slowly, but still fast enough, and in addition, the elements of fertility would be retained and the whole area of the soil uniformly moistened. Again, underdrained soils liable to become water soaked, become hard and impacted. Insects do not penetrate to any considerable depth, and the soil holds water like a dish, to be slowly evaporated by the sun, rendering it, by this very process, cold, sour, and unfertile. So also tilth and drainage prevents the washing away of fertilizing properties during continued rains;



TRENCH PLOWING.



ENGLISH STEAM PLOWING.

GANG PLOWING IN THE NORTHWEST.

the moisture is absorbed, and passed down through the soil instead of running along the surface, and thence into the nearest stream.

Breadth of furrow-slice or cultivator.	Space traveled in turning an acre.	Extent plowed per day, at the rate of	
		18 miles.	16 miles.
Inches.	Miles.	Acres.	Acres.
7	14⅛	1¼	1⅛
8	12¼	1½	1¼
9	11	1 3-5	1½
10	9 9-10	1 4-5	1 3-5
11	9	2	1¾
12	8¼	2 1-5	1 9-10
13	7½	2⅓	2 1-10
14	7	2½	2¼
15	6½	2¾	2 2-5
16	6 1-6	2 9-10	2 3-5
17	5¾	3 1-10	2¾
18	5½	3¼	2 9-10
19	5¼	3½	3 1-10
20	4 9-10	3 3-5	3¼
21	4 7-10	3 4-5	3⅓
22	4½	4	3½
23	4¼	4 1-5	3 7-10
24	4	4⅓	3 9-10
25	4	4½	4
26	3 4-5	4¾	4 1-5
27	3 3-5	4 9-10	4⅓
28	3½	5⅛	4½
29	3½	5¼	4 3-5
30	3⅓	5¾	4 4-5
31	3 1-5	5	5
32	3 1-10	5 4-5	5¼
33	3	6	5⅓
34	2 9-10	6 1-5	5½
35	2 4-5	6⅓	5 3-5
35	2¾	6½	5 4-5
37	2⅔	6¼	6
38	2 3-5	6 9-10	6⅛
39	2½	7⅛	5⅓
40	2½	7⅓	6½
41	2 2-5	7¾	6¾
42	2⅓	7	6⅔
43	2 3-10	7 4-5	7
44	2	8	7 1-10
45	2 1-5	8 1-5	7¼
46	2 1-6	8⅓	7 2-5
47	2 1-10	8	7 3-5
48	2 1-12	8¾	7¾
49	2	8 9-10	7 9-10
50	2	8 9-10	8 1-10
51	1 9-10	9 1-5	8¼
52	1 9-10	9½	8 2-5
53	1 9-10	9¾	8½
54	1 4-5	9 4-5	8 9-10
55	1 4-5	10	8
56	1¾	10¼	9
57	1¾	10 2-5	9 1-5
58	1 7-10	10 3-5	9⅓
59	1 7-10	10¾	9½
60	1 3-5	10 9-10	9 7-10
61	1 3-5	11 1-5	9 4-5
62	1 3-5	11⅓	10
63	1 3-5	11½	10 1-5
64	1½	11 7-10	10⅓
65	1½	11 4-5	10½
66	1½	12	10 3-5
67	1½	12¼	10 4-5
68	1½	12 2-5	11
69	1 2-5	12 3-5	11⅛
70	1 2-5	12¾	11⅓
71	1 2-5	12 9-10	11½
72	1 2-5	13⅛	11 3-5
73	1⅓	13⅓	11 4-5
74	1½	13½	12
75	1⅓	13 3-5	12⅛
76	1 3-10	13 4-5	12¼
77	1 3-10	14	12½
78	1¼	14¼	12 3-5
79	1¼	14 2-5	12¾
80	1¼	14 3-5	12 9-10
81	1 1-5	14¾	13 1-10
82	1 1-5	15	13¼
83	1 1-5	15⅛	13 2-5
84	1 1-6	15⅓	13 3-5

PLOWING THREE ABREAST. The using of four horses in heavy plowing, by attaching one pair before the other, is going out of general use, for the reason that it has been found in practice that three horses or mules working abreast or beside each other, accomplish about as much work, and do it more easily for the team and driver, than can be done by the old-fashioned way of hitching them before each other. Very many farmers, however, do not receive this modern innovation with favor, because they have not learned the proper manner of making the whiffletrees, and adjusting the driving-lines, and the draft of the plow. In plowing with four horses, two abreast, the forward horses, drawing in a nearly horizontal line, exert a large portion of their strength at a disadvantage not only to themselves, but also to the team immediately behind them. The disadvantage in plowing three abreast is that the middle horse is apt to be sweated unduly in hot weather by contact with the outside horses, but the evil is more than counterbalanced by the gain in power. The most simple attachment and the one in most common use is a draw-bar, having its clevis or draft-clip one-third of the way from the end to which the double-trees are to be attached. To the other end a single-tree is attached by a chain long enough to bring it in line with the single-trees attached to the double trees at the other end. The whole should be of such a length as will bring the middle horse immediately in front of the plow-beam. Various patented three-horse-trees are before the public, all more or less complicated, but the one here described is simple and within the reach of all. Mules work admirably three abreast, and in their case the draw-bars and the whiffle-trees may be very much shortened, since they will work much closer than horses without danger of overheating. The most simple way of driving them is by means of a single line attached to the outside bits of the near and off horse, tying their heads together at suitable intervals by the bits. This will do if the team and driver are both steady and reliable. But perhaps a better plan is to hitch the team drawing upon the double tree, as is commonly done for two horses. Then pass a check-line from the outside bit of the third horse through the hame-ring, and attach it to the main or driving line of the middle horse. It should be about eight inches longer than the ordinary check or cross rein. Another method is to attach two single lines to the middle horse, having shorter reins from the near and the off horse passing to the same bit, so that each shall bear alike. The near check-lines of the outside horses should then be attached to the near main line of the center horse, and the off or right-hand check of the outside horses should be fastened to the off-side main line of the center horse. Of course, in plowing with three horses or mules abreast, the plow must be so adjusted that the line of draft will be immediately behind the middle horse.

PLUM. The plum delights in a rather compact, well drained, rich, loamy soil. It is one of the most hardy of trees, quite as much so as the apple, and would be generally cultivated were it not for the ravages of the curculio. There has never yet been found any successful means of preventing the ravages of this pest, except jarring the trees, from the time the fruit is the size of a small hazel nut, until it is fully grown, catching the insects on a sheet and killing them. Unfortunately this takes so much time at a very busy season that none but special orchardists will take the trouble. The varieties as recommended by the American Pomological Society, include many. The following do well generally: Coe's Golden Drop; Damson; Lombard Imperial Gage; Jefferson; Smith's Orleans and Washington. Besides those mentioned the following are considerably planted in the Eastern States: Bavay's Green Gage, also known as Reine Claude de Bavay; Duane's Purple; Lawrence's Favorite; McLaughlin; Prince's Yellow Gage; Washington and Yellow Egg, or White Magnum Bonum. In the Western States the Wild Goose is almost univeraally planted, in every collection. The history of the plum gained from a variety of sources ia as follows: The most generally distributed, and longeat known species of plum, is the common plum (*Prunus domestica*), coming originally from the Caucasus, and the mountains of Talysch. It is cultivated extensively in Syria, where it has passed into numerous varieties. It reached Italy about the time of Cato, and Pliny speaks of *ingens turba prunorum*, by which he designated the numerous varieties. At the present day the different varieties may be referred to the following kinds: 1. The little cherry-plum, (*Prunus cerasina*). 2. The genuine plum (*Prunus prunaria*), of a little larger size; here belong the damsons. 3. The spilling or egg-plum (*Prunus Arm niaca*), which includes the mirabellas and reine claude, or green-gage plums. 4. The almond plum, (*Pru us amygdalina*). And, finally, 5. the *Prunus Persicaria.* Although the plum has been distributed over the whole of Europe, and extended far to the north, it is little known in eastern Asia, and it is doubtful whether it occurs in northern China. The bullace plum (*Prunus insititia*), which is closely allied to the common plum, is of slight importance. It is found wild on the Caucasus. It is difficult to decide whether it occurs wild, or only run wild in Greece and Southern Europe. This tree has certainly not been derived from the sloe bush. Here also belongs the Bear plum (*Prunus ursina,*) a thorny tree-like ahrub, which grows wild everywhere about Mt. Lebanon, the sweet, pleasant fruit of which, the size of our damson, is eaten not only by the bears, but serves as food to the inhabitanta of the mountain regions. Among the plums, in the most extended sense, may be mentioned the cultivated cherry (*Prunus cerasus*), and the wild black cherry (*Prunus avium*). The former, growing wild in the mountain forests of Southern Caucasus, was brought to Italy from Cerasunt, in Pontus, succeeding the conqueat of Mithridates, seventy-four years before Christ. Another fruit, the size and shape of our plum, the ibametara, or Spanish plum, is obtained from a tree, (*Spondias myrobalanus,*) which grows wild in the forests of Jamaica, and is cultivated in the northern regions of the tropical parts of Brazil. The natives eat the sweetish acid flesh, prepare a sauce, and manufacture drink from it. Another species of the same genus, (*Spondias dulcis,*) is found on the Friendly Islands. The tree is fifty feet high, with a atraight trunk, the thickness of a man, and bears clusters of large, oval, golden yellow, stone fruit, like pomegranates, the fleshy putamen of which is sweet and palatable, and reminds one of the pineapple. The *Spondias tuberosa* and *Spondias lutea* in the West Indies, also furnish edible fruit. The Icaco plum (*Chrysobalanus icaco*, L.) is also worthy of mention. This tree-like shrub, with its fruit similar to the damson, grows wild as well as cultivated in the forests along the shores of South America, and on the wet coasts of Carolina. It has been introduced from Africa, where it occura from Senegal to Congo. The fruit is made into preserves and brought to Europe.

PLUMBAGO. Native carburet of iron; black lead.

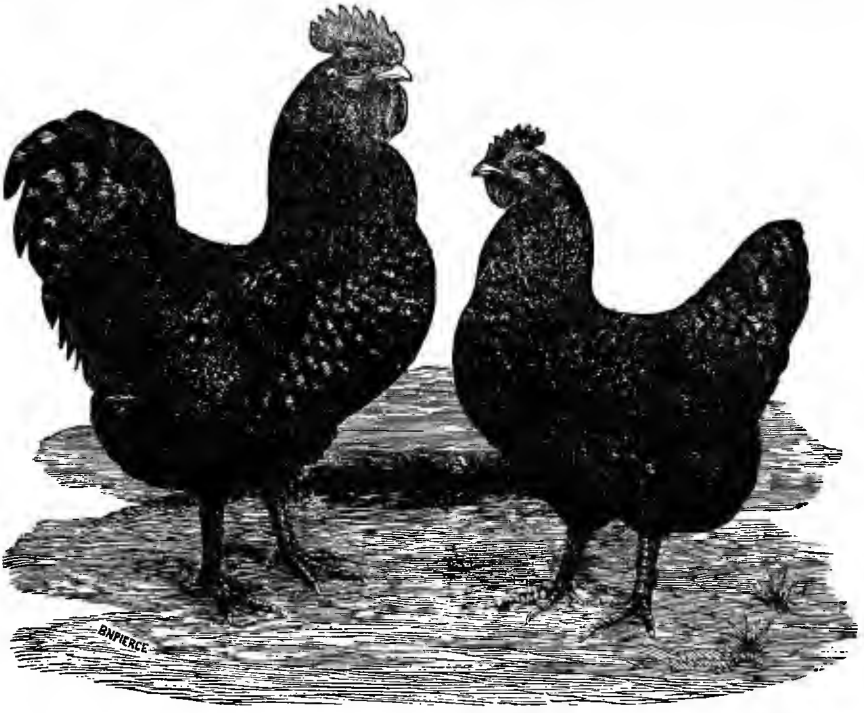
PLUMULA. The leaf-like portion of the embryo.

PLUS. More: marked by the sign +.

PLUTONIC ROCKS. Unatratified crystalline rocks, like granite, porphyry, basalt.

PLUVIAMETER. The rain gauge.

PLYMOUTH ROCK FOWLS. Of late years this breed has come distinctively into notice, and has had many admirera. The original fowls are claimed to have been bred by Dr. J. C. Bennett from a cross of a Cochin-China cockerel with a hen, a cross between a fawn-colored Dorking, the great Malay and the wild Indian fowl, and were first exhibited in Boston in 1849. As might have been expected, as the breeds multiplied, they varied much in form and color, from the blood of the various fowla with which they were imbued, and it was found difficult to fix a uniform character, nevertheless they were large fine birds, the cocks weighing eight to ten pounds, and the pullets six to seven pounds at a year old, and the plumage rich and variegated. At length as the breed became more constant in their characteristics, and ten years ago they were described by Lewis in his Poultry Book as follows: The cocks are usually of a beautiful red or speckled color, and the hens of a darkish brown. Some of the colors thrown by this breed, are not dissimilar to the Dominique fowl. They have very fine flesh, and are fit for the table at an early age. The legs are quite large, and usually blue or green, but occasionally yellow or even white, and frequently have five toes upon each foot. Some of the varieties have the legs occasionally slightly feathered. They have large single rose-colored or red combs and wattles; cheeks are rather large; tails stout and short, and very small wings in proportion to their bodiea. The chicks are quite hardy and have the same uniformity in size and appearance as those of the pure bloods of primary races. The hens make good mothers and close setters. Accompanying this we give a cut of a pair of Plymouth Rock fowls, cock and hen. Mr. F. H. Corbin who has written a pamphlet on the Improved Plymouth Rocks, upon mating and breeding these fowls from a fancier's standpoint, has some good suggestions, and which will apply to all parti-colored fowls where the penciling and markings are of importance, and also as applicable to breeding generally. We extract as follows: It is a fixed natural law that the beat and fittest survive. It makes no difference, in the application of this law, whether you are treating of an analytical truth or the propagation of life; it still remaina the central point around and toward which all researches muat be directed. It is in direct proportion to the observance of this law by fanciers that they are enabled to perpetuate and improve all classes of fowls. The first requisite in mating fowls for any purpose, is to secure birds possessing strength, vigor, and stamina. Select stock famed for these requirements, and you will be very sure of obtaining strong, hardy chicks. Let the parent stock consist of birds standing head and shoulders above ordinary stock, and you will be little troubled with roup and its kindred diseases. Breeders disagree as to the age of breeding-birds; but we have found that cockerels nearly or quite a year old, mated to two-year-old hens, usually give the best results. A cock two years of age, mated to early pullets, will also be found satisfactory. The best authorities agree that the ages of the males and females should vary, and for this reason cockerels and pullets should seldom be mated together, unless it is particularly desirable to secure or render permanent some peculiar characteristic or point in that way, and then they should be at least a year old. If the cocks and hens have been entirely separated during the several months preceding the mating, so much the better, as the added amount of vigor is very beneficial. Most breeders find it advantageous to pursue this plan. In the breeding of no other choice stock is it considered beneficial, or allowable, even, to permit the male to roam at will with the females during the entire year, and choice fowls will be found to be no exception to the rule. In breeding for fancy points, one should understand exactly the object sought, and have a clear idea of the means to be employed in obtaining that object. The different elements, about to be brought together and harmonized, must be carefully studied, and if there is necessarily a defect in either cock or hen, it should be counterbalanced by perfection on this point in the other. For instance, if the cock's comb be defective in any way, as lop combed, the hen's comb should stand perfectly erect, and be fine in other respects, in order to breed out the defect arising from the comb of the cock. Of course, no defective bird should be bred from unless it is absolutely necessary, and under no circumstances should a male and female both having the same defect be bred from. No over-fattened birds should be used in the breeding-pen, as non-fertile eggs will abound if they are. In a perfect mating, the sire should possess beautiful plumage, perfectly marked, fine symmetry, and as large size as is compatible with full vigor. The constitutional requirements, which apply with equal force to the hen, have already been spoken of, and need not be repeated here. The dam should excel in productiveness and size, while the shape and plumage must not be lost sight of. This union is the most desirable one for any purpose. Symmetry is especially important in breeding for points, as, in the show-pen, it is marked higher than any other single qualification, and by many judges is again marked in estimating breast and body. The standard of excellence requires that the breast of a Plymouth Rock be broad, deep, and full, and the body large, square, and compact. This necessitates birds for breeding that are both of large size and the improved shape; as no other is or can be square in shape. In breeding Plymouth Rocks to feather, it should be remembered that they are parti-colored, and, therefore, more difficult to breed exactly true to a particular shade than the solid-colored breeds. Moreover, being a somewhat recent cross, the tendency to revert in color is stronger and the result more perceptible. That there has been no



PLYMOUTH ROCK FOWLS.

well-settled rule in regard to mating with a view to breeding true to feather is well known, and each breeder, be he experienced or a beginner, has been left to his own devices. The result has been a whole or partial failure in a majority of yards. Five different matings have been advocated and practiced as follows: A male light in color mated to dark females; a male dark in color mated to light females; a male dark in color mated to dark females; birds matching in the show-pen; a female medium in color mated with a male about two points or shades lighter in color.

PNEUMATICS. The science which treats of the mechanical characters of gases and vapors.

PNEUMATIC TROUGH. A chemical utensil used for the collection of gases over water or fluids. It consists of a vessel of tin or wood containing water, in which is placed one or more ledges, within two inches of the surface. On the ledges the jars which are to receive the gases rest, and they are at first filled with the fluid of the trough, but the gas passing up into them from conductors, the fluid is displaced.

PNEUMONIA. This is lung fever in horses, or an inflammation of the substance of the lungs, followed by secretion and effusion of lymph, which solidifies the lungs, at length causing death by suffocation, or recovering by the gradual absorption of the matter. It is brought about by various causes, as standing in drafts when heated, bad ventilation in the stables, or from anything causing inflammation, or which may run into it. There will be a chill, cold ears and legs, a dry dull cough, sometimes a semi-bloody mucus will issue from the nose, the pulse will be rapid, and the heat of the body often 103° or 104°, or even more. If, in addition, upon striking with the knuckles over the lungs, at the chest, there is a dull sound, (when in the well animal it is resonant), the disease is positive. If the animal is young and full of blood, it may not be amiss to bleed at the very outset, but blistering and purging must be avoided, and bleeding except as stated. A counter-irritant may be had by means of mustard poultices to the chest. For the fever, give every two hours until the fever is abated, one ounce sweet spirits of nitre, and six ounces solution of acetate of ammonia, in six ounces of water. To reduce the pulse, give alternately with the above, once in two hours, twenty or thirty drops of tincture of aconite, in a little water. This will also relieve the pressure on the lungs, but these doses must be watched; and upon the first appearance of depression of the system, as failing pulse, sweating or trembling, the doses must bt intermitted or discontinued. The animal must be well clothed, comfortably sheltered, and the bowels loosened, if necessary, by injections of warm water. If there is much weakness, give two drachms each of carbonate of ammonia and camphor, twice a day, and in the form of a ball, and in case of great exhaustion, a gill of whisky occasionally. Good nursing, and simple, cooling, laxative and nutritious food, will accomplish more than any heroic treatment, and the animal must be watched until fully recovered, giving gentle exercise, but not real work, and plenty of grass if possible.

PNEUMO-ENTERITIS. (See Cholera, Hog.)

PNEUMO-THORAX. A collection of air in the cavity of the pleura.

POA. An extensive genus of valuable natural grasses, to which the meadow grass, blue grass, and many important species belong. The botanical characters of this genus are, *panicle* loose; *spikelets* three or more flowered, or even two-flowered, with the pedicels of a greater number of florets; florets articulated with the rachis; *paleæ* two, nearly equal, awnless, *scales* oval, acute, gibbous at the base. (See Grasses.)

POACHING. The treading of cattle in wet meadows, in which they leave their hoof marks.

POA COMPRESSA. (See Blue Grass.)

POA TRIVIALIS. (See Blue Grass.)

POD. Those of the pea and bean are called *legumes;* those of the radish, mustard, and cruciferæ are *siliques.*

PODENTIA. The stalk which supports the fructification of some lichens, as the reindeer moss.

PODICEPS. A genus of palmipedine birds, in which the web of the foot is not perfect.

POIKILITIC. Variegated. In geology, the new red sandstone formation.

POISON OAK. *Rhus radicans* and *R. toxicodendron,* the former being also called poison vine: it is a climber, the stem throwing out an abundance of black roots. The milky juice is poisonous, and, to some persons, the volatile particles thrown off from the plant. They produce inflammation and swelling, resembling erysipelas. Light diet, laxatives, and a lotion of sugar of lead and water to the part are best.

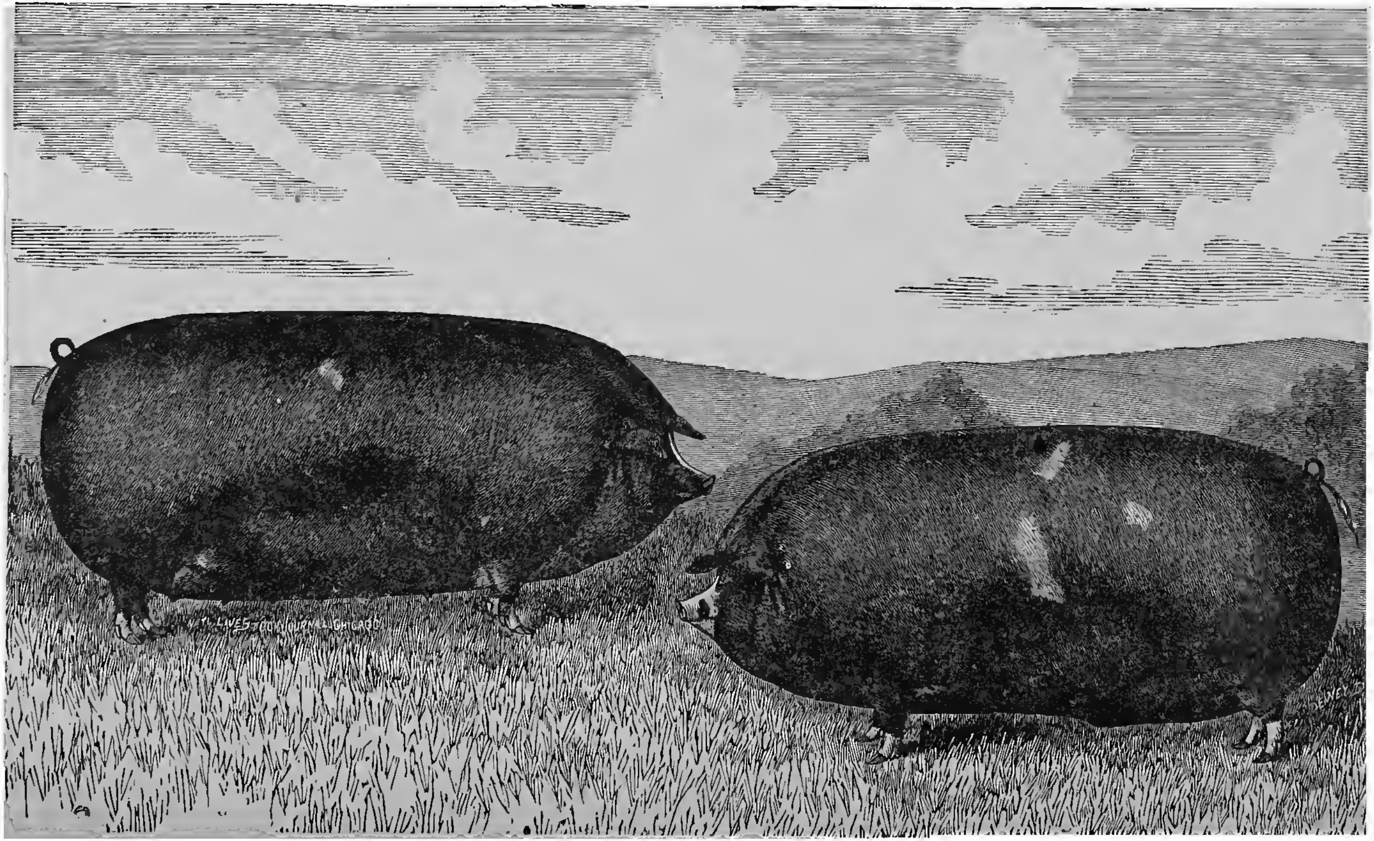
POISONS. Bodies which disturb or destroy the natural functions of the body. They are narcotic, acrid, or septic. Many are to be met by antidotes; but with animals the stomach pump is to be looked to as the chief means of relief.

POISONS AND ANTIDOTES. As a rule the lower animals are seldom poisoned, if left to themsleves. Poisoning is oftener the result of carelessness or the stupidity of stablemen, giving quack nostrums to improve the coat or courage of the horse. If the cause is not known, give at once, a quart of linseed oil, to be followed by an injection of twenty to thirty drops of croton oil, three or four ounces of spirits of turpentine, and one pint of linseed oil, to be thrown into the bowels with considerable force; supplement this with injections of lukewarm milk and water, or simply warm water. If there is considerable exhaustion and drowsiness, administer whisky freely. If, however, a stomach pump is at hand, use this first in preference to all other means. For special cases of poisoning, the following are antidotes: Aloes; give as an antidote, two ounces of laudanum in a quart of linseed tea, repeat in two hours if necessary. Inject also the same dose into the bowels. The same antidote will also apply to poisoning by castor seeds and croton seeds. For fungus poisoning, as smut, toad stools, bad fodder, etc., give full doses of purgatives, both by the mouth and by injection, and afterward support the strength with stimulants and nourishing food. Indian poke, or white hellebore poisoning is relieved by means of whisky in full doses or a tumbler full at a time. In poisoning by laurel, give purgatives and injections, and also stimulate with whisky. Stramonium poisoning is to be met by quart doses of linseed oil, to which two ounces of laudanum is added; injections, and stimulants, as whisky, to keep up the strength. So far as mineral poisons are concerned, they must not be allowed about, and especially must arsenic be kept out of the hands of stablemen. As a medicine, in intelligent hands, it is valuable; as a condiment, to give fictitious fire and spirit, it is vicious.

POISONS AFFECTING PLANTS. These are few in number, and principally mineral. Of gases, the common illuminating gas is the only one to be feared, acting fatally, when from leakage of the underground pipes, it is taken up by the roots. Plants quickly suffer if kept in rooms lighted with gas, and hence the reason why florists refuse to leave rare plants long on exhibition at public places lighted with gas. It has been generally credited that Paris Green acts injuriously to plants when used for destroying insects, and many think that it may be taken up to such a degree as to become poisonous to persons eating the fruit. This, however, is groundless, except when the poison may have been applied, and lodging on the fruit or vegetable to be eaten, and taken into the stomach. Hence poisonous compounds should never be used on plants, the fruit of which is designed for eating after the season of inflorescence. This will not apply to underground tubers, like potatoes; upon cabbage, cauliflower and other plants which may retain the poison, it should not be used at all. Among the mineral poisons fatal to vegetable life, the compounds of boracic acid have been found to be a veritable plant poison. M. Peligot has discovered that the free acid, and its compounds, when present in the soil in moderate quantities may cause the death of plants in a short time. A remarkable exception to the rule for the influence of aluminium salts is said to have been observed by Bergstrand, in a locality near Westerbotten, in Sweden, *Rubus articus* was found in a flourishing condition upon a sandy soil containing as high as three per cent. of alum. The dry plants yield 4.68 per cent, of ash, containing 12.60 per cent. sulphuric acid and five per cent. alumina; but these figures are very much reduced when the percentage of alum in the soil is sufficiently low to admit of the growth of grass and grain. In such case the sulphuric acid of the ash amounts to only five per cent. In relation to the influence of arsenical compounds, when present in the soil, the chemist of the Department of Agriculture, in a late report, gives the results of interesting and conclusive experiments of much value, showing that there is but little to fear. The investigation was made to determine: 1 If applied to the soil, can arsenic or arsenious acid be absorbed and assimilated in the economy of plant-growth? 2. If absorbed and assimilated, can it be taken up in sufficient quantity to become prejudicial or injurious to the health of consumers? 3. If not taken up by the plant during growth, does it by its presence in the soil exert a poisonous influence upon the plant itself? 4. If it exerts a poisonous influence upon the plant, to what extent may it exist in the soil before it becomes injurious? The experiments were conducted as follows: Fifteen common flower-pots, of as nearly uniform size as possible, were selected, and each one filled with a measured quantity of good garden-soil. With the soil of each pot were then thoroughly intermixed quantities of Paris Green, ranging from 100 milligrams to one gram. Thus one pot contained 100 milligrams; that next to it contained 200 milligrams; the next 300; and this quantity was increased until it finally reached one gram. In the other pots, the increase was made more rapid, and the other pots contained two, three, four, and five grams respectively. After the soil had thus been carefully prepared, a given number of peas, all of which were carefully selected, so as to secure as nearly as possible those of the same size and appearance, were planted in each pot. At this time, the question arose, What would be the effect of arsenic in combination, as arsenite of potassa and arseniate of potassa? For the purpose of determining this, two other series of pots were prepared in the same manner as before, placed alongside the former. In these experiments, for the sake of comparison, one pot of soil was prepared without addition of any poisonous compound. It is evident from results that the arsenical compounds in the soil did produce an injurious effect, and in some instances, in fact in the majority of them, it was decidedly marked. In case of the Paris Green, it is not noticed until the quantity present in the soil reaches 500 milligrams, and that in the other pots the size of the plants decreases regularly as the quantity of arsenical compound present increases. In case of the arsenite of potassa, the effect seems to be more immediate. This may be due either to the greater solubility of the compound or to a possibly larger quantity of arsenious acid. The potash compound seemed nearly pure, being crystallized, and the purity of the copper compound was not estimated. Yet in this case the effect does not seem decidedly marked until the quantity present reached 300 milligrams. To the influence of arseniate of potassa the plants seemed to be more sensitive still; for those in the pot containing but 100 milligrams seem to be affected. Yet even when 200 milligrams are present, the plants seem to thrive tolerably well. What, then, are the quantities of these compounds which may be applied to the soil for the various purposes in practical agriculture before effecting any injurious results? The amount of soil in each of the pots employed in these experiments was 91.5 cubic inches. In case of the Paris Green, the limit is 500 milligrams for this quantity of soil, which is equivalent to 145.6 grams per cubic foot, or 906.4 pounds per acre, calculating for a depth of one foot. The limit for arsenite of potassa, being 300 milligrams per 91.5 cubic inches, is about 540 pounds per acre. Though the plants seem to be affected by even a small quantity of arseniate of potash in the soil, the chemist was nevertheless inclined to the opinion that this compound may be applied at the rate of 150 pounds per acre without any great injury to the crop. For practical purposes, however, it is never necessary to apply in any case so large an amount. These results are confirmed by the water-culture experiments of Prof. Freytag in his investigations upon the influence of the sulphurous and metallic fumes of the Freiberg Metallurgical Works upon the vegetation of the surrounding fields. He found that plants were killed when placed in solutions containing one-eightieth per cent. arsenious acid. one-fiftieth per cent. sulphate of zinc, one-fortieth per cent. sulphate of copper, one-twentyfifth per cent. sulphate of cobalt, one-fifteenth per cent. sulphate of nickel, and one-fifth per cent. sulphate of iron. Mons. E. Heckel states that twenty-five milligrams of arsenious acid, or the soluble arseniates in ninety grams of water, prevents germination and destroys the embryos of seeds. It is difficult, however, to agree with Prof. Freytag in the statement that the arsenious acid and the oxides of zinc and lead can not be injurious to vegetation on account of their property of forming insoluble compounds in the soil, since in some of my preliminary experiments presence of such insoluble compounds as the arseniates of barium, strontium, and magnesium was sufficient to prevent germination. Again, in reports upon the composition of certain mineral waters of Germany, we notice statements of the presence of such insoluble compounds as arsenite of iron in solution. These facts argue against the possibility of accumulation of sufficient arsenic in the soil by regular applications of Paris Green in the quantities recommended for the destruction of the Colorado potato beetle. When rotation of crops is observed, and application of the poison can not therefore take place upon the same plot more than once in three or four years, it is probable that each application, being acted upon by the natural solvents in the soil, will be removed by drainage before another is made. And yet, even when annual applications have been made, so much time must elapse before the limit could be attained that no injury need be feared from this cause. Now, can arsenic be absorbed and assimilated by the plant in the economy of growth? Investigations, the chemist says, give a negative reply. All of the plants grown, from the largest to the smallest, were examined by careful application of Marsh's test; yet he failed in any case to detect the presence of arsenic. Before making the test, the organic matter of the plant was destroyed by boiling it in hydrochloric acid with addition of potassic chlorate, and the solution filtered. He also carefully examined potatoes which had been subjected to applications of Paris Green, and which were furnished from Delaware and Sandusky, O., and Chambersburgh, Pa., and failed in any case to detect the presence of arsenic. With these facts before us, and without considering what might be the result of a series of experiments continued through a number of years, we must conclude that plants have not the power to absorb and assimilate from the soil compounds of arsenic, and that though arsenical compounds exert an injurious influence upon vegetation, yet this is without effect until the quantity present reaches: for Paris Green, about 900 pounds per acre; for arsenite of potassa, about 400 pounds per acre; for arseniate of potassa, about 150 pounds per acre. The influence of illuminating gas upon the aerial portions of plants, is shown to be as follows: The subject of the influence of illuminating gas upon vegetation has, until within a short time, been neglected. In 1873, observations made in Berlin determined the fact that gas escaping from the pipes exerted an injurious influence upon the surrounding vegetation, with the roots of which it came in contact, and careful experiment showed that this effect could be observed when so small a quantity as twenty-five cubic feet per diem was distributed through 144 square feet of soil to a depth of four feet. In fact, the plants whose roots permeated this quantity of soil, 576 cubic feet, were by such treatment killed in a short time, and it appeared that less time was required to produce this effect when the surface of the ground was closed and more compact. During the same year, J. Boehm made experiments by passing coal-gas through the soil of pots containing fuchsia and salvia; of the ten plants experimented upon seven died in four months. Further experiments convinced him of the fact that the plants were killed, not by the direct action of the gas upon the roots, but by poisoning the soil. It seems, therefore, pretty well established that when coal-gas permeates through the soil it has an injurious action upon the vegetation with which it may come in contact. My attention has, however, been attracted to a somewhat different action of the gas, which seems equally as destructive as that just described. Boehm found, in the course of his investigation, when cuttings of willow were placed in bottles containing a small quantity of water, and otherwise filled with illuminating-gas, as the buds developed and the leaves began to appear the latter rapidly withered and died before reaching complete development. Now, this is the direction taken in my investigation. In Boehm's paper, he does not state the percentage of gas in the atmosphere necessary to produce the effect described, and my object was therefore, if possible, to estimate the approximate quantity of gas required to bring about such results. The question arose out of a dispute concerning the destruction of an extensive stock of camellias in Philadelphia, in which it was alleged that the loss was due to the escape of gas from the street-mains. It was shown that the main was broken; that during the winter, the ground being frozen, there was no means of escape of the gas other than to work its way through the subsoil, and into the atmosphere through the ground of the interior of the greenhouse. The distance between the main and the greenhouse is not stated, but it appears that trees growing between the former and the latter were completely killed. It was to determine whether the result in dispute could be effected by the action of the gas. The plants were growing in pots placed upon stands and it was therefore impossible that they should be injured through the medium of their roots. It was then to determine what might be the influence of the gas in question upon the aërial portions of plants that the investigation about to be described was instituted. In order to secure such conditions that the plants might be confined in an atmosphere containing a given quantity of gas, and yet be provided with the requisite degree of light, heat, and moisture, the plants were placed in closed boxes, provided with glass sides, the joints of which were cemented with white lead. When all was secured, a tube of glass was introduced through the side of the box and connected with the stop-cock of a gasometer. The stop-cock of the gasometer was then opened, and the gas allowed to flow into the box, until the entire contents of the former were transferred to the latter. The whole was then allowed to stand until the following day, when the gasometer was again filled with gas taken from the pipes supplying the laboratory, and one-half the contents transferred to the box. On the next day, press of other duties called my attention away from this work entirely, and the box therefore received no gas. On the fourth day, however, one-half the contents of the gasometer were introduced, and another day allowed to intervene before another application. Gas was then introduced into the box on four occasions, so that the amounts transferred, allowing ten gallons for the capacity of the gasometer, were: February 24, about ten gallons; 25th, about five gallons; 27th, about five gallons; March 1, about five gallons. During this time, an occasional leaf, as well as one of the buds, fell from the plant, and on March 2, on opening the box to apply water to the plant, a slight jar caused a number of the leaves to fall. The plant was then carefully removed from the box, when a sharp shock caused nearly all the leaves to fall. The leaves which had fallen were then gathered about the base of the plant, and the whole placed in a convenient position, together with the other plant, which had been submitted to the same conditions excepting the treatment with gas, and which remained perfectly sound and healthy. Now, what was the relative amount employed? The dimensions of the box were: horizontal cross-section, two feet square; height, four feet. Calculating from the data at hand, we find that the amount first introduced was equivalent to about 7.7 per cent. of the entire volume of the box, and that the quantity subsequently introduced, being one-half this amount, was but 3.35 per cent. Without making any allowances for escape of the gas by diffusion, which probably took place, reasoning from the fact that when the box was opened no odor of gas was perceptible within the box, we find that after the first day the amount of gas did not exceed four per cent. of the volume of the box. It is, however, probable that the average quantity was much less than three per cent., and I am inclined to the opinion that if camellias or other plants be confined in an atmosphere containing continually one to two per cent. of illuminating-gas, they must suffer and ultimately be killed.

POLAND-CHINA SWINE. This breed is famous all over the West, and also is locally known in Ohio as the Magie hog, from the name of one of its successful breeders there. It is described by the committee on Poland-Chinas at a convention of the National Swine Breeders' Association. In a number of articles on swine we have freely used these reports as they have appeared at this convention, since the peculiarities of the various breeds were then pretty fully discussed. There were two reports, a majority report and a minority report; the latter being finally adopted. It is as follows: In the early history of swine-breeding in the Miami Valley, in Ohio, it is clear, from the best written authorities available, and from oral testimony, that there were two breeds which, to a great extent, had been profitably crossed with the common bristled breed of the country. These were the Russia and Byfield breeds. The Bedford breed is also named in connection with the other two. To what extent it was used can not now be readily determined. In 1816, we have positive proof from an unquestioned source that the Shakers of Union Village, situate in Warren county, O., and being four miles from Monroe, in Butler county, purchased at Philadelphia one boar and three sows, of what was, at the time, believed to be pure China. They were represented to be either imported or the immediate descendants of imported stock. They were called Big China hogs. These animals were the first China hogs ever brought into southwestern Ohio. Subsequently other China hogs were introduced and extensively used. The shakers and other judicious breeders in Warren and Butler counties continued to use the breeds at command, and produced, by repeated crosses, a hog of exceedingly fine qualities for that period, which was generally known as the Warren County hog. These hogs, continually increasing in good qualities, were bred in both counties, and the very best specimens were carefully and interchangably used, so as to make the best crosses. Such was the progress that had been made in forming the ground-work of a good specimen of a hog. This condition of the breed remained measurably constant until about the year 1835 or 1836, when Mr. Munson Beach, of Warren county, first introduced the Berkshires, which were obtained from C. M. Bement, of the State of New York. Other lots of Berkshires continued to flow into the Miami Valley, until about 1841. The Berkshire blood was liberally infused into the stock existing not only in southwestern Ohio, but in Kentucky also. Crossing with the Berkshires was almost exclusively done until about 1838 or 1839, when Mr. William Neff, of Cincinnati, imported some choice specimens of the Irish Grazier. This breed soon grew into high favor, and, as a consequence, was liberally used in making crosses with the best specimens of the crosses previously made. This intermingling of blood—this crossing of breeds—continued for some time. In a few years, however, the use of the pure-blooded Berkshire was entirely discontinued, and there were no further importations made of the Irish Grazier. The breeders of swine in the Miami Valley settled down to the conviction that the basis of a good breed of hogs had been established, and that in the future, judicious and discriminating breeders could use, and, if necessary, modify the material furnished so as to meet the highest demands of the public. For more than thirty years no new blood has been introduced into our breed, and no effort made to obtain a new supply of the blood of either breed previously used. While this is true, our breeders have not been indifferent to the further improvement of our breed. Stimulated by their success, they have perseveringly aimed to improve what they had been so successful in forming. The best points or qualities have been preserved, and, when practicable, have been made even more excellent. All defective points or undesirable qualities have been corrected or improved by the care, skill and judgment of our experienced breeders. Thus we have a breed thoroughly established—of fixed characteristics, of fine style, and of unquestioned good qualities, which can be relied upon for the production of a progeny of like qualities and character. The following is presented as the characteristics of the foregoing breed: The best specimens have good length, short legs, broad, straight backs, deep sides, flanking well down the legs, very broad, full, square hams and shoulders, drooping ears, short heads, wide between the eyes, of spotted or dark color; are hardy, vigorous, and prolific, and when fat are perfect models all over, pre-eminently combining the excellencies of both large and small breeds.

POLARITY. The quality in the particles of bodies adjusting themselves in given directions, as north and south, in the magnet.



POLAND-CHINA SWINE.

POLE. A rod. Sixteen and one-half feet.

POLLARD. A tree cut or lopped to form a low brushy top.

POLLED. Hornless.

POLLED CATTLE. Of the polled breeds of cattle there are several in England. Among the polled breeds that have acquired reputation are the Angus Polled, the Suffolk, and the Galloway. The latter have been, of late years, brought to the United States, bred and exhibited at our fairs. Those specimens we have seen have proved to be most admirable cattle, thick meated, deep flanked short legged, fine boned animals. That they were considered most valuable cattle, and worthy of being brought here in the early settlement of the country, is evidenced from the fact that forty years ago these hornless, (or Muley) cattle as they were termed, were not extremely rare often breeding back by reversion, entirely hornless or with but the rudiments of horns, and were classed as gentle and good milking cattle. Gentleness is a characteristic of the pure Galloway. Even the bulls are noted for their docility and quiet tempers. For the reason that this breed of cattle have of late years been growing in favor in the West, as grazing and milking cattle, (see article Galloway cattle), and, for the further reason that it is thought that crossing the Galloway on the half wild Texan will be most valuable, it has been advocated that they be carefully experimented with. While it is undoubtedly true of all pure or thorough-bred stock that, they will improve permanently the character of any native stock upon which they may be crossed, it seems especially so of the Galloways to-day. It has been held by some that pure breeds can not improve the mixed stock of a country. This is a fallacy. They must and do as the magnificent Short Horn Hereford and Devon grades amply testify in all our great markets. That the Galloways have many valuable points can not be denied. One of these is their absence of horns, another is their extreme docility. If by crossing Galloway bulls with Texan cows their horns could be toned down, their wildness tamed, their frames thickened with superior flesh, their milking qualities improved, and the whole animal ameliorated, it would seem as possible with the Galloway as by any other means we know. It is certainly well worthy of trial.

POLLEN. The pollen of plants is the fecundating dust or minute grains of organized fertilizing matter which, falling upon the pistil of the flower, throws out hair-like tubes, which penetrate through the whole extent of the vascular tissue of the pistil, and reaching the ovules, fertilize them, thus rendering them capable of perfecting the seed, and reproducing plants of their own kind. The pollen, therefore, represents the male element in plant life. The male and female organs (stamens and pistils) are sometimes in the same flower, as in the apple. These are called perfect flowers. When the stamens and pistils are on different flowers and on the same plant, as in the white oak, they are called *monœcious.* When in different flowers and on different plants, as on hemp, they are called *diœcious.* How the fertilization in different plants is accomplished, Mr. Horace Piper, of Maine, relates as follows, taking perfect flowering plants, *monœcious* and *diœcious* plants, to illustrate the three classes: In the first class the pollen is conveyed from the anthers to the pistils in some cases by actual contact of the two organs, as in the potato (*Solanum tuberosum*); in others, by the elasticity or spring of the stamens at the time the anthers emit the pollen, by which action it is scattered on the pistils, as in the mountain laurel (*Kalmia latifolia*); and still in others by the position or length of the stamens, being above or hanging over the pistils, and, therefore, requiring no accidental means to fertilize the plant. In the second class the staminate flowers are generally situated above the pistillate, and over them on the same stalk, so that the pollen falls upon the pistils by the mere force of gravity, as in Indian corn, in which the part commonly called the spindle contains the staminate flowers, and the ears the pistillate. In the third class the staminate flowers are on one plant, and the pistillate on another; therefore, the pollen must be conveyed by some artificial means from the stamens to the pistils. This is readily accomplished by the wind or insects. The grains being light and very numerous, are easily wafted by the breezes and severe winds in sufficient numbers, and to the necessary distances, to accomplish the desired object. But, lest this mode of conveyance should prove inadequate, nature has provided another security just referred to, namely, the transmission by insects when in search of honey for their food. Passing from the flowers of one plant to those of another, often to great distances, they carry the pollen which has adhered to their legs and bodies, and deposit it on the pistils of the flower of another plant, which is thus rendered fertile, and is as certain of producing fruit as if the pollen actually fell upon the pistils from the anthers of the same flower. In this way we may account for the fact that some trees of this class though thrifty and producing an abundance of flowers, do not bear any fruit. It is simply because there is no staminate plant sufficiently near from which pollen may be conveyed by any of the means above to the insulated plant. And, again, the plant may be so far distant as not to admit the pollen to reach it at all, or only on some extraordinary occasion, and, therefore, it would produce fruit only when such accident should happen to occur, which might never be. We have a very curious instance of the manner in which fertilization is sometimes effected in this class of plants in the case of the *Vallisneria spiralis,* in which the flower of the staminate plant detaches itself from its stalk and swims to its mate, attaches itself to it, and remains until it becomes fertilized, when both flowers wither and sink beneath the surface of the water in which they grew, the one to perish, and the other to mature seeds, and sow them on the muddy bottom below. As illustrating the action of pollen, Broigniart and others think that when the hair-like tube of the pollen-grain passes through the orifice in the coatings of the ovule, and reaches the nucleus, or embryo sac, it emits a spermatic or plantlet germ, which passes through the wall of the embryo sac and enters the germinal vesicle contained in it. The vesicle corresponds to the germinal spot, or vesicle, in the egg of birds, and the ovum of mammiferous animals. The germ remains in the vesicle, and finally becomes the embryo fully developed into a plantlet, as may be seen in the bean and other seeds. These tubes sometimes grow to great length, and are many days in penetrating the whole length of the pistil. Indian corn will furnish a good illustration. The pistils of this plant, which are commonly called the silk, grow to the length of ten or twelve inches, and yet these slender pollen-tubes penetrate the whole distance from the point where they come in contact with the pistils to the nucleus of each rudimentary seed.

POLL EVIL. (See Fistula.)

POLY. A prefix of many words, as polygon, polypetalous.

POLYGASTRIC INFUSORIALS. The class of animalcules with many stomachs inhabiting infusions.

POLYGONACEÆ. Herbaceous, apetalous exogens, with triangular, scaly fruit, and an ochrea. The rhubarbs, sorrels, docks, and buckwheat belong to this family.

POLYPES, POLYPI. The name of an extensive group of radiate animals in the system of Cuvier, associated together by the common character of a fleshy body, of a conical or cylindrical form, commonly fixed by one extremity, and with the mouth situated at the opposite end, and surrounded by more or less numerous arms or tentacles.

POLYPODY. *Polypodium.* Having numerous root-like feet. This is an extensive genus of ornamental ferns. The hardy kinds are well adapted for ornamenting rock-work, or they may be grown in pots, in light loamy soil. All the species may be readily increased by dividing the roots, or by seeds.

POLYPUS. A fleshy tumor of the nostrils or womb. It is only removed by the knife in the hands of a competent surgeon.

POMACE, POMAGE. Refuse of fruits, after pressing for cider.

POMACEÆ. Rosaceous plants, with an inferior ovary, as the apple, pear, etc.

POMEGRANATE. A tropical fruit. A beautiful, hardy, deciduous shrub, growing twelve or more feet high. *Punica granatum,* and its varieties, produce their splendid flowers and fruit very plentifully from July to September. They all grow well in a light, rich loam, and strike root freely from cuttings or layers; the rarer varieties are sometimes increased by grafting on the common kinds. The pulp of the fruit is of an agreeable acid, and the rind is highly astringent.

POMMEL. The front prominence of the saddle.

POMOLOGY. (See Horticulture.)

PONE, PONES OF BREAD. Small loaves, usually applied to a particular form of corn-meal bread.

PONIES. Of ponies, the Shetland, the Canadian, the Indian pony, and the Mustang are the principal breeds worthy of notice. The Shetland ponies are the smallest of all the breeds of ponies, though there are ponies having some of the characteristics of the Shetlands in northern Sweden, Iceland, Wales, and also on the southwest coast of England; in fact wherever civilization has extended, in Alpine regions and in high northern latitudes, there will be found ponies, rough and often shaggy in their coats, dwarfed, and hardy little horses, undoubtedly the descendants of more powerful ancestors, that being taken to those inhospitable regions have, in the course of many generations of exposure and hardship, been dwarfed to their present size, until the more diminutive of them are scarcely larger than some of the improved breeds of mutton and long-wooled sheep. (See Canadian, Indian, Mustang, Narragansett pacer, and Shetland ponies.)

PONS VAROLII. An eminence of the medulla oblongata, at the top of the spinal marrow.

PONTIA. The genus of insects to which the cabbage butterfly belongs.

POPLAR. *Populus.* The genera contains the aspens, the downy-leaved poplar, the cottonwoods, and the balsam poplars. Also, as introduced trees in the United States, the Lombardy poplar, and the Abela or Silver-leaved poplar. Both of these latter are undesirable trees, from the fact that the Lombardy poplar, *populus dilatata* dies young, and the abele, *P. Alba,* spreads by suckers so as to become a nuisance. The aspens are, the American aspen, *P. tremuloides,* or quaking aspen, a small tree, with smooth greenish bark; the larged-toothed aspen, *P. grandidentata,* larger than the preceding, with smoothish gray bark. The downy-leaved poplar, *P. heterophylla,* found in swamps from New England to Illinois, and southward; the cottonwood poplars, *P. Monilifera,* or necklace poplar; and *P. Angulata,* or angled cottonwood. The balsam poplars, *P. balsamifera,* or tacamahac, and the variety *candidans,* or balm of Gilead poplar, and the black poplar, *P. nigra,* found sparingly East, and supposed to be an introduced form of the European black poplar. The poplars belong to the *Salicaceæ,* or willow family. The cottonwoods are extensively planted in the West by early settlers, on account of their quick growth, and fair quality for firewood and other uses, but to give place to better trees when they can be grown.

POPLITEAL. Relating to the space behind the knee joint.

POPPY. *Papaver.* The common poppy, *P. somnifera,* furnishes the opium of commerce, obtained by the exudation of the milky sap, upon being cut. *P. dubium,* is the smooth fruited corn poppy. Argemany, or prickly poppy, *A. Mexicana; Stylopharum,* or celandine poppy, *S. diphyllum,* is found in the Mississippi valley, east of the Mississippi, from the lakes to Kentucky. Chelidonium, or celandine, *C. majus,* is a perennial weed growing in waste places. Glancium, or horn poppy, *G. luteum,* is an introduced plant from Europe, runs wild in Maryland and Virginia. Sanguinaria, or blood root, *S. Canadensis,* belongs to the poppy family, as also does *Eschscholitzia Californica,* and *Douglasii.* These are handsome flowering plants, the juice colorless, and curious, from the fact that they have the odor of muriatic acid.

POPULIN. A crystalline substance obtained from the bark of the aspen.

PORCATE. In entomology, divided into ridges; a surface on which there are several elevated and parallel grooves.

PORCELAIN CAPSULES. Evaporating basins of porcelain; this material resists a great heat, and is not readily acted on except by potash or soda.

PORCH. An arched or flat-ceiled vestibule to a door or building.

PORES. Small spaces existing between the atoms of bodies; also distinct apertures through leaves or membranes, from which perspiration and vapors pass.

PORK. The flesh of swine, after being cut for use, is called pork. In cutting it should be done with reference to the use for which it is intended. In the great pork packing establishments the cutting and curing has special reference to the particular markets to which it is to be sent, and even including the particular form of the hams, shoulders, bacon, and pickled pork. Thus in hams, sometimes the hip bone is removed at the socket, or left entire. The shank is left long, to the hock joint, or cut well up to the ham. So with the shoulder, it may be cut square, back of the shoulder blade, and the neck, or trimmed rounding. The bacon pieces may embrace the entire side from ham to shoulder, or the flank piece may be separated from the back piece. Sometimes the tips of the ribs are left in, but generally the whole of the ribs are taken out and the backbone always. In making pickled pork, whole hog pork contains two hams, two shoulders, the side meat, chops and feet. Mess pork is the side meat containing the bone, clear pork is the side meat containing no bone. Another grade of clear pork is made by taking the flank, or lower half of the side for bacon, and the upper half or back for barreling, after being divested of the bone. In putting up pork for home consumption, the chops, shoulders, hams and flank pieces of the side meat should be used for smoking, and the back pieces of the side meat barreled. The shoulders and hams should be trimmed close, and the hip bone removed from the ham at the socket joint. All the bone should be removed from the bacon and pickling pieces, since these, as well as the scrap pieces from the hams and shoulders, are more economically used fresh than otherwise; the lean and fat scraps, may be used for sausage, and the bones with the meat adhering, in whatever way may suit the taste. With the backbone the large loin muscle should be removed, since this lean strip is not good salted, from the excess of salt it takes up. Fat pork will not become over salt. From forty to fifty pounds of salt will cure a barrel, but if double this quantity is used no harm will ensue, but the undissolved salt will remain good in the barrel. The layers should be placed in regularly, the skin side next the barrel, the whole packed as firm as possible, with plenty of the best coarse salt between each layer. Then fill the barrel with pure water, soft water preferably, the meat to be kept entirely covered with the brine, kept cool and there is no danger of spoiling. The bony and other pieces that remain for eating fresh may be kept for a long time by packing in a barrel with snow, or even by hanging on the north side of a building, where they may be kept frozen. Hams, shoulders and bacon must be so cured that they will be only seasoned enough for use, without freshening, (a part of the preservative process being smoking). This may be done by making a pickle of salt, saltpetre and sugar or molasses, and immersing the meat therein for two or three weeks, the pieces having been previously rubbed with salt and allowed to drain for two or three days. The proper proportion for a pickle of beef and hams should be as follows: Make a brine that will bear up an egg so it will show a section the size of a ten cent piece. Then to each 100 pounds of hams or shoulders to be cured, add six ounces saltpetre, and two pounds of sugar. In this immerse the meat after it has been rubbed with salt and laid to drain two days. The hams will be fit for smoking in from two to three weeks, according to size, though they may lie a month without injury. Before smoking, drain dry, and rub the whole thoroughly with black pepper. Hams intended for boiling, may be prepared by this recipe. For broiling the following recipe is one of the best we have ever used, since by this process the fat as well as the lean will be found superior: The hams are to be laid regularly on a platform and rubbed with salt, and allowed to drain for two days, being careful not to place one on another. Each fifteen or sixteen pounds of ham will require one pound of New Orleans brown sugar, two ounces of pulverized saltpetre, and half a pound of coarse salt pulverized. Rub the flesh and end of shank with one-third of the saltpetre and cover with sugar about one-quarter of an inch thick. In five days rub the skin briskly with sugar, and the flesh side with another third of the saltpetre mixed with three parts of sugar and one of salt, on the seventh day repeat the process. In three days more rub again with half sugar and half salt and repeat in seven days. Let the ham lie for five or six days, clean the flesh side and rub with New Orleans molasses as long as the meat will absorb it, the idea being to saturate the ham with sugar and molasses, using only salt enough to flavor it; when cured through, rub with black pepper. Hang the hams in the smoke house and dry with gentle heat for a week, and then smoke with a green hickory fire smothered with sawdust of the same, or of bur oak; clean corn cobs also make an excellent smoke. If the smoke house is so constructed that the smoke can be admitted at the top so much the better. The temperature of the house should never be above eighty or eighty-five degrees, and the meat should not freeze either before or after smoking. The smoking, or drying (for the meat should be dried rather than smoked), may continue until the skin assumes a light chestnut hue, and when fully cured and dried, put them in muslin bags well sewed and whitewashed to guard against flies. Beef may be cured in the same manner, and mutton hams as well, but in this case little or no smoke should be used, but simply a heat of about eighty degrees. It may be objected that this is an expensive method. Very true, but the pleasure of eating the delicious broiled slices will fully warrant the cost. A common plan of dry salting is to use salt and saltpetre in the proportion of one pound of the former to one ounce of the latter. Rub with salt and drain for three days, then warm the mixture just so it can be borne by the hand, and rub every three days until the meat is cured to the bone, packing in a hogshead, box, or other convenient place, each time the rubbing is performed, placing the under pieces on top. When cured, clean and rub with ground black pepper, and dry, smoke, and preserve as before directed. If wanted very nice, add half a pound of sugar to each pound of salt, rubbing in the sugar at the second handling before using the salt. In dry salting it is quite essential that the salt used be rubbed on hot.

PORK, CLEAR. Side pork for barreling, free from lean.

POROSITY. The property of bodies, whereby they transmit fluids or gases, and which depends on their pores.

PORPHYRY. A hard red or gray stone of the nature of granite, and consisting of feldspar, with quartz or hornblende. It occurs in the oldest dikes.

PORRECT. Extending. When a part extends horizontally.

PORRIGO. Scald head, ring-worm, tetter. Tar ointment, or dilute carbolic acid is a remedy. Cleanliness and attention to the general health, are essential.

PORTAL. The lesser of two gates.

PORTAL CIRCULATION. The circulation of the venous blood from the abdominal viscera through the liver to the right auricle of the heart.

PORTER. A beer colored with dark malt or molasses.

PORTICO. A projection from a building, supported by arches or pillars.

POSITIVE ELECTRICITY. A surplus of electricity. (See Electricity.)

POST ABDOMEN. The five posterior segments of the abdomen of insects, or the tails of some crustaceans.

POTASH. *Alkali. Protoxide of potassium* The substance popularly known under the name of potash is a combination of oxygen and of a metal called potassium. This metal was first separated from the alkali in 1807, by Sir Humphrey Davy, and is interesting on account of its properties, and as having been the first of its class obtained by means of the galvanic pile. It is of a bluish color, is soft, and may be worked by the fingers as wax. Its luster is eminently metallic, and can not be retained in contact with the air. This metal must be kept under oil of naphtha, (which contains no oxygen,) because, if left in contact with the atmosphere, it will absorb oxygen, and again become potash, or oxide of potassium. It is lighter than water, its specific gravity being 0.865. At the temperature of freezing water it is brittle; as the temperature rises it first becomes soft, and then liquifies long before the thermometer reaches the boiling point; and, finally, is volatilized at a red heat, giving out vapors of a beautiful green color. When a piece of potassium is thrown upon water its affinity for oxygen is so great that the water is decomposed, the oxygen of the water uniting with the metal with such rapidity that the hydrogen is ignited, and continues to burn until the metal is completely oxydized. If the remaining water be then examined it will be found alkaline, and capable of turning reddened litmus blue. Potash, as known in commerce, is an impure compound of all the soluble salts extracted from wood ashes by lixiviation and evaporation to dryness. Pearl-ash contains fewer impurities, being prepared by a more perfect calcination in contact with the air, promoted by constant stirring, by which means the carbonaceous matter, as well as the sulphur, is dissipated. Resolution and evaporation, toward the close of the process, produce a white granular appearance. Pure potash, (vegetable alkali, caustic potash, etc.,) is solid, white, and fusible, and does not undergo decomposition at any degree of heat to which it may be subjected; but it is deliquescent, and, when exposed to the air, absorbs the carbonic acid of the atmosphere, and will consequently effervesce by the application of any of the stronger acids, such as sulphuric, nitric, or chlorohydric. It is one of the most powerful bases, and so caustic as to alter all organic substances with which it comes in contact, and it is hence used as an escharotic in surgery. Not only does it dissolve many animal substances, but also changes the nature of vegetable products, particularly when its action is aided by heat. Potash is never found pure in nature, being always combined with acids, such as carbonic, sulphuric, chlorohydric, nitric, tartaric, oxalic, etc. That which is extracted from the ashes of vegetables is mixed with divers other salts, varying according to the vegetables from which the ashes have been procured, the nature of the soil, and the kinds of manure used in their production. In preparing caustic potash, regard must be had to the substance used for the carbonate. That produced by reducing to ashes the tartrate of potash is the most pure. By successive crystallizations any degree of purity may be gradually attained. The carbonate of potash is decarbonized by the application of caustic lime to a solution of the carbonate in boiling water, the boiling being continued for a time. The carbonate of lime, formed by the absorption of the carbonic acid from potash, precipitates, and may hence be easily separated by decantation or by filtration. To ascertain when all the carbonic acid has been removed, it is only necessary to add a few drops of acid to an equal quantity of the clear solution, when any effervescence will indicate the incompleteness of the operation. The decomposition being effected, the solution is allowed to settle, the clear liquid is decanted, and the residuum is thrown upon a filter, which may be of straw, clean sand, cloth, or paper. The evaporation should be rapid until the water is dissipated, when the product may be run into moulds, as may be desired, or allowed to cool on the sides of the evaporating pan. It should then be broken into fragments and secured in glass vases with emery stoppers. Potash thus obtained is known in commerce as potash prepared with lime. It is not absolutely pure, but contains salts, such as chlorides, sulphates, silicates, and aluminates of potash. By dissolving this potash in alcohol, and evaporating first in a still, to economize the alcohol, and finally in a silver vase, a product is obtained known as potash á l'alcohol, which is used in analyses, and may be considered the purest found in commerce. Potash, if not the strongest, is at least one of the strongest of the bases, and forms salts that are very permanent—all of which are soluble in water; such as are but slightly so being rare exceptions. In agriculture it is never used alone, but in combination with substances produced in the arts or found in certain localities, as geological formations, such as green sand, occurring along our eastern littoral, (sea shore between high and low water), varieties of feldspar, lavas, etc. Potash is widely diffused throughout nature. It enters into the composition of animals and plants, and of all the soils which support vegetation; and it forms one of the constituents of the predominant rocks of which the earth is composed, such as granites, mica-schists, the sienites, lavas, basalts, etc. Where the soil is formed from a rock in which there is no potash, it would be useless to seek it, or to anticipate fertility without supplying this element. (See Manures.)

POTASSIUM. The metallic basis of potash; it is white and brilliant, but soft as wax, lighter

POTATOES.—Rank and yield of the States, with average annual product for the past nine years.

Rank.	States.	Total value of Crop.	Value per Acre.	No. of Acres.	Amount of Crop. Bush.	Yield per Acre. Bush.
1	New York	$14,866,076	$41.88	324,793	28,491,225	90
2	Pennsylvania	6,336,454	48.84	133,681	11,251,325	84
3	Illinois	5,467,423	40.92	133,618	10,273,875	78
4	Ohio	4,826,256	46.89	108,962	8,916,150	81
5	Michigan	3,892,405	42.93	90,372	7,688,237	85
6	Wisconsin	3,320,564	38.35	90,732	7,866,100	87
7	Iowa	2,950,511	34.82	84,359	7,389,025	88
8	California	2,946,483	95.77	31,415	3,339,187	107
9	New Jersey	2,726,187	56.33	48,650	3,868,112	79
10	Maine	2,702,522	55.36	49,791	5,094,525	104
11	Kansas	2,482,380	49.43	50,121	4,302,250	85
12	Missouri	2,202,821	37.68	60,544	4,661,850	75
13	Vermont	2,185,101	58.23	37,676	4,850,637	129
14	New Hampshire	2,112,280	64.23	33,331	3,643,850	112
15	Massachusetts	2,031,948	73.92	25,793	3,159,775	107
16	Indiana	1,924,981	37.22	52 231	3,860,250	71
17	Connecticut	1,615,511	63.40	26,178	2,237,812	87
18	Minnesota	1,174,041	35.87	32,704	3,301,125	100
19	Kentucky	1,005,180	39.25	26,114	1,866.500	72
20	Maryland	831,151	47.95	17,386	1,217,975	70
21	Virginia	747,848	42.92	17,485	1,268,325	72
22	Tennessee	658,878	44.27	15,008	1,192,175	79
23	North Carolina	590,865	57.87	10,343	884,925	86
24	West Virginia	528,741	43.00	12,606	964,912	78
25	Nebraska	471,975	31.14	15,367	1,466,250	97
26	Rhode Island	460,362	70.25	6,631	603,437	93
27	Texas	458.508	108.77	4,867	395,000	84
28	Oregon	452,080	72.29	6,209	768,137	123
29	Arkansas	405,833	68.91	5,882	510,975	85
30	Nevada	300,340	186.50	1,729	191,600	113
31	Georgia	290 466	82.85	3,701	261,342	73
32	Alabama	256,594	76.82	3,425	259,088	74
33	Mississippi	250,192	77.84	3,295	256,200	78
34	Delaware	206,583	58.25	3,670	294,937	80
35	South Carolina	83,855	73.57	1,145	92,475	80
36	Louisiana	54,420	62.43	876	55.600	64

than water, specific gravity 86, and spontaneously inflammable on water. Its compound with one equivalent oxygen, potash, is one of the most important chemical agents; a powerful base and an alkali.

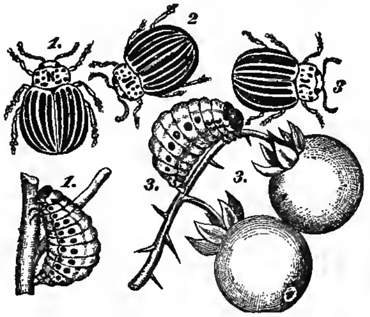
POTATO. *Solanum tuberosum.* The potato is one of the most important of field crops, as food for man, ranking next to wheat, its limits of cultivation being carried further north than that of spring wheat and extending south to the equator. One of the singular circumstances in connection with the common name of the potato is that it should be called Irish. This was undoubtedly caused from the fact that early in this century it became the principal sustenance of the Irish peasantry. According to the younger Hooker, the wild species has passed into several varieties. The cultivated species are innumerable, and each year adds a host of new varieties as candidates for popular favor. In its wild state, the tubers never exceed two inches in length, and the flavor is insipid but not bitter. In Chili and Peru, it is peculiar to hilly or rocky soils, and found near the coast. The cultivated potato is a native of America, but tuberous solanums are found in the East and West Indies, having the ends of the stolons thickened into tubers, as *S. commersonii*, *S. Maglia*, and *S. immite.* In Mexico, there are also tuberous solanums, as *S. demissum*, *S. cardiophyllum*, and *S. verrucosum.* This latter variety produces small, but well flavored tubers. In the Argentine Republic, in some of the mountain regions, a species of solanum grows wild, and is also cultivated for its tubers. The natural history of the potato leaves us in some doubt as to its original nativity. It was carried to England, in 1565, by Sir John Wamkins, from Santa Fe de Bogota, where it was found growing wild, at an elevation of from 8,000 to 13,000 feet above the ocean, in elevated valleys surrounded by high mountains, and above the range of Indian corn. The climate is dry and cool, and, being near the equator, is not subject to great extremes of heat and cold. An attention to this fact will be of advantage to cultivators of this crop in climates not so well suited to it. It is said to have been known, at that early day, in various parts of North America; and after its introduction into England, from Virginia, by Sir Walter Raleigh, in 1586, it began to attract more and more notice, until, at this day, the potato, as one of the root crops, and maize among cereals, have been among the most valuable food-producing plants ever bestowed upon man. From a history of the potato, by Bonjean, published in 1836, we find that it came originally from the intertropical parts of the American continent; that it grows spontaneously from Carolina to Valparaiso, in Chili. The celebrated Joseph Pavon, one of the authors of the Peruvian Flora, found it growing wild in the vicinity of Lima, Peru, where the Indians cultivated it abundantly for their subsistence. Lopez de Tomera, a Spanish priest, in his general history of the Indies, published in 1553, mentions the *Papas*, the name by which it was known to the Indians. Joseph Acosta says that the Peruvians employed it in lieu of bread roots, which they called *Chunno*, or they ate them fresh and boiled. Before its introduction into England it had already been very extensively diffused throughout the south of Europe. The botanist, Charles L'Ecluses (Clusius), about the year 1588, is said to have been the first European writer who mentions the potato. In 1631 he published a description of the root, and says that it was then so common in some parts of Italy that it was eaten by men and fed to hogs He doubts whether it was known to ancients; thinks that it may have been the *Arachidna* of Theophrastus. Cortusus, another botanist, supposes that it was the *Pycnocoma* of Dioscorides. In 1590 Gaspard Bonhin received frem Scholtz a colored drawing of the potato, and recognized it as a solanum. Mathiola afterwards described it in his commentaries upon Dioscorides. It was in Italy that potatoes were first cultivated to any extent, and from thence it began to be spread over Europe, about the year 1550. The Italians called them Tartoffoli, or ground truffles, and from this is said to have come the German name, Kartoffle. Parmentier, in 1783, succeeded in introducing the potato into general cultivation in France, and spent much time and research in demonstrating, by chemical experiments, that the potato was both a healthful and nutritious food. The following is a summing up of an analysis of the potato, by the author first quoted, Bonjean: Starch, peculiar animal matter, bitter aromatic resin, Parenchyma (fibrous matter), Solanin, Asparagine, colored Albumen, a sugar principle, a gum principle, citrate of lime, citrate of potash, phosphate of potash, phosphate of lime, free citric acid, Silica, Alumine, Magnesia, Manganese, oxide of iron, Iode, Brome and water of vegetation. An analysis of the Mercer potato, by Charles T. Jackson, M. D., of Boston, Mass., gives in 100 parts by weight:

Constituents.	Per cent.
Water	75.80
Starch	12.54
Cellulose	3.62
Other matters, not separated	8.04
	100.00

In an analysis of the ash of the potato, according to Prof. Norton, it contains:

Chemical Elements.	Per cent.
Carbonic acid	10.04
Sulphuric acid	7.01
Phosphoric acid	10.03
Chlorine	2.07
Lime	1.08
Magnesia	5.04
Potash	56.55
Soda	trace.
Silica	8.06
Iron	0.05
Charcoal in ash, and loss	10.07
	100.00

After its introduction into England, by Sir Walter Raleigh, it was cultivated in Ireland in 1610, in Alsace in 1720, in Scotland in 1728, in Switzerland in 1730. Since this time its cultivation has been extended to every civilized country, and many barbarous ones, from the equator to the 64th parallel of north latitude, has added millions to the population of the earth, and has rendered almost unknown those famines which so often desolated the civilized world. Indeed, it has been said that if the sanguinary wars of the French Revolution had occurred before the introduction of the potato, that Europe would have been decimated by famine. Very many theories have been, from time to time, promulgated relating to the deterioration of the potato, principal among which are degeneration, or a wearing out of its vital forces, which nature herself has disproved by recuperating, in a measure, this valuable esculent. Another theory is that the disease is produced by excessive cultivation and high manuring, thereby inducing an extremely succulent and watery growth, and consequently a greater liability to be affected by atmospheric and other changes which are constantly taking place. That it is due to this cause, measurably, is more than probable, from the fact that the potato, when given its true, or normal condition, i.e. a cool and equable temperature, allowing it to make its growth without subjecting it to violent atmospheric changes, it uniformly produces fair crops, as, for instance, if we plant early varieties early in the spring in the Northern States, upon new or fibrous soil, however well manured, we may confidently expect to harvest a good crop about the first of August; and also, if we plant in June, we may expect to gather a crop in September or October, if the season is proper, that is, not wet and hot; these are conditions that are not suitable to a healthful growth of the potato. In fact, a season that produces good wheat is apt to produce good potatoes, but a season that is subjected to violent extremes of heat and cold, especially upon highly manured soils, is sure to deteriorate and reduce the potato crop. The effect of high cultivation, and strong and especially green manures, is such as to induce an extremely succulent growth of vines, and while in this condition, if such weather occurs as would cause rust in the wheat plant or rot in fruit, the cells, being gorged with sap, are ruptured, and decomposition taking place, it is immediately seized upon by microscopic fungi, and unless seasonable weather succeed the poisonous matter is communicated to every part of the plant, and a total destruction of the plant ensues. That it is due to atmospheric causes, in a great measure, there is no doubt, and it is also as true that a hot murky atmosphere is the superinducing cause. Indeed, the disease has not been confined exclusively to the potato, for about the same time, we have accounts of similarly affected bulbs and roots, as tulips, hyacinths, the sweet potato, various vegetables and fruits, as tomatoes, the yam, the cocoa, apples, peaches, pears and other fruits. That it is due to engorgement, or something analogous, is probable—the rupture of the plant cells presenting a proper nidus for microscopic insects and fungi, the vitality of the plant is more and more impaired, until finally, as in the case of annuals, they are completely destroyed; but perennials may linger from year to year, until they finally succumb, or, during more favorable seasons, eventually recover. This is a principal reason that we find certain plants growing within certain isothermal lines, or where the temperature is natural to them, and it is not strange that the potato, requiring as it does such peculiar conditions for its normal development, being transplanted to such a variety of climates, should become diseased, and the seeds of that disease be carried, perhaps, to every country where it is cultivated. The potato requires a cool, equable climate. Michigan and Wisconsin are celebrated for their fine crops of potatoes, so are Maine and Nova Scotia. Now it is known that the climate of Michigan, nearly surrounded as it is by extremely deep water, and protected besides by dense forests, has a comparatively equal climate; it is warmer in winter and cooler in summer, not subject to so violent alternations of heat and cold as are the more open countries in the same latitude lying west of lake Michigan. In fact the delicate Carter potato was, for many years after it ceased to be profitable elsewhere, successfully grown on the Eastern shore of lake Michigan, 200 miles north of Chicago, upon the clearings of the dense forests, for the reason that their summers, although short, are marked by a steady degree of heat and moisture, sufficient to mature the crop; so of Maine and Nova Scotia. Wisconsin is subject to greater atmospheric variations, lies nearer the great treeless prairies, but is at the same time sufficiently protected to be exempt from the more violent extremes. Indian corn requires a much greater average heat to mature its crop than the potato, but at the same time it will stand greater extremes of heat and cold. The least frost blackens the potato vine, but the corn simply turns yellow, subsequently recovers, and under favorable conditions as to moisture and heat matures its crop. The theory of degeneration as producing the potato rot, is essentially this, that reproduction, by extension as by layering, by cuttings and by eyes, tends so to impoverish the vital energy of the plant from generation to generation, that it continually becomes more and more weakened, until finally it dies. Now plants, as well as animals, may be called both viviparous and oviparous, not scientifically, but, as a condensed illustration; and some plants, as the potato, dahlia, artichoke, etc., are both oviparous and viviparous—oviparous as reproducing themselves from seeds or ovules, and viviparous, reproducing themselves by tubers, or offsets or buds. Now the seed, in order to reproduce the living organism, must first undergo certain changes, must be placed in its nest and be hatched; but in reproduction from the bud, it is fed by the sap itself until it has put forth its roots and leaves and is enabled to draw from the earth its proper nourishment. It seems to be a law of nature that the higher we breed either the animal or plant, the more susceptible it becomes to climatic and other changes; that the more we refine the more delicate becomes the tissue; that the higher we feed the more liable are we to engorge, and with engorgement comes rupture, disease and death. We have forced the potato, by high feeding and extreme culture, into excessive growth; under certain atmospheric or other conditions, engorgement ensues, the cellular tissue is ruptured, the vitiated sap decomposes, fungi attack it, and unless assisted by other conditions favorable to the normal condition of the plant, finally ends in its complete destruction, or partial disorganization, leaves it in so feeble a condition that it is not able to fully elaborate its starch, and instead of the dry, mealy potato, we have the soggy, waxy and watery one. It is no argument, for it is only a theory, against the theory that reproduction from seed does not bring it back to a healthful condition, for the seed being but a minute part of the whole plant, may necessarily be diseased from the parent, and might, perhaps, continue so for generations, until it wears out just as fever and ague wears out upon the human patient. But under fortuitous circumstances, it may at last regain its original health and vigor. The history of potato culture in the West shows plenty of failures, resulting from plantings in the month of May and early in June, for the reason before stated that the hot sun and dry atmosphere of July and August; or else the sudden alternations of wet and dry, hot and cold, are not conducive to the steady growth which the potato requires. But even under these circumstances, we may measurably succeed, by mulching, when the conditions are such that early planted ones do not perfect their growth before the heat of summer ensues. Upon clay or heavy loams, we advise planting as early in the spring as possible, upon deep fall plowing, by marking the land three feet apart, making a deep narrow furrow, which will of course be left filled with the fine earth. If you plant in hills, mark the other way, two feet apart, and put two strong single eyes in each hill. If in drills, plant the eyes about ten or twelve inches apart, stepping upon each piece in order to press it firmly into the earth, or if two rows are planted at once, this must of course be omitted, in which case a roller may be passed over the land before covering by the cultivator or hiller Notwithstanding the assertion that it makes no difference whether the eye lies uppermost or not, it is bad practice to allow some eyes to lie up and some down, since they do not appear above ground at one time. Have them lie in the furrow as they are to grow, the eye up; cover about four inches deep. As the weeds start, or from rain, a crust forms, harrow thoroughly with a light drag, and continue to do so as often as necessary, until the rows can plainly be seen, then with any suitable implement, turn a light furrow away from the potatoes, and within four or five days turn it to them again. and continue to earth them from time to time, until at the time of blossoming the vines will be supported by a moderately broad and high hill. If the vines now grow so as to cover the ground and shade the ridges or hills, you may confidently expect to harvest a crop, unless the season is unfavorable, that is, wet and hot, or with alternations of heat and cold. We have gathered fine crops by filling between the hills with litter or fine manure, to obviate the effects of heat and drought. What the potato most craves is a moist, equable temperature of the earth, which can only be obtained, in variable seasons, by having the ground covered with the vines or mulch. If these conditions are secured you will not be much troubled by weeds, but if so you must get them out by hand or otherwise. Neither potatoes nor any other crop will thrive among weeds. In case blight attacks them severely cut the tops, but if slight leave them alone—they may recuperate; and in no case when attacked by disease should you dig them to save them, they are safer in the ground than out, unless the land is very wet, in which case, if they are dug, they should be spread thinly, and some absorbent, as lime, powdered charcoal, or dry muck, mixed with them. When thoroughly ripe they may be dug and placed in narrow piles to sweat and dry, after which they may be stored where they are to remain through the winter. More attention should be used in the storing of potatoes than is generally allowed. Those intended for eating should be kept as much as possible from the light and air, and all potatoes should be kept at such a temperature as to prevent germination; but potatoes intended for planting certainly sprout more kindly and more quickly if they are exposed to the air sufficiently in the fall to become even greened before storing, on the same principle, perhaps, that the roots of trees dug in the autumn and healed in, get calloused and ready for growth in the spring. The planting of small potatoes can not be too much deprecated, and why otherwise intelligent farmers will practice planting inferior and small potatoes, and at the same time be so careful in saving seed of corn and other cereals, is something wonderful. A crop may be reduced one-half in four years by the experiment. A single strong eye, with a liberal quantity of tuber attached, is as good as more. In planting whole potatoes none but the strongest eyes grow, while if all the apparent eyes are cut out there will still be latent eyes, which, under favorable circumstances will germinate. The small potatoes, however, in this day of high prices, may be utilized thus: Select a certain portion of the best potatoes, sufficient for the seed of the next year to be saved from, and if you continue this practice from year to year, you may plant the small potatoes for the market crop; but in no case must seed be saved from the produce of these small potatoes. It is not necessary that we send long distances for change of seed. We have proved, from our own experience, that plants will not degenerate if care is taken to save seed from the best specimens, but will, on the other hand, improve yearly. The potato is liable to the attacks of a number of insects. Those doing the most damage are cut worms eating the young shoots, the white grub which eats the roots to some extent, but whose principal mischief is in eating holes in the tubers. The most destructive insect, however, is the Colorado Potato Beetle. The cut above at 1, 1, shows the beetle and larva of Colorado potato beetle; 3, 3, *D. juncta*, of the South which feeds on the horse nettle: 2 shows an apparent cross between the two, in which the thick heavy line of the juncta is supplemented with a yellowish line running partly through it longitudinally. (See Supplement.)



POTATO FLY. *Cantharides.* There are many varieties.

POTATO STARCH. The farina of the potato.

POTTER'S CLAY. Plastic clay either of a white or red color.

POTTING. The placing of young plants in pots. The chief end attained by potting is the power, says Lindley, of moving plants about from place to place without injury; greenhouse plants from the open air to the house, and the reverse; hardy species, difficult to transplant, to their final stations in the open ground without disturbing their roots; annuals raised in heat to the open borders and so on; and when this power of moving plants is wanted, pots afford the only means of doing so. It also cramps the roots, diminishes the tendency to form leaves, and increases the disposition to flower. Another object is to effect a secure and constant drainage from roots of water; a third is, to expose the roots to the most favorable amount of bottom heat, which can not be readily accomplished when plants of large size are made to grow in the ground, even of a hot-house; and finally, it is a convenient process for the nourishment of delicate seedlings. Unless some one of these ends is to be answered, and can not be effected in a more natural manner, potting is better dispensed with.

POTTING PLANTS. The successful florist knows that the best soil for plants is a normal one, or one in which it naturally grew, and naturally seeks to give it those conditions as near as he can. All this requires a pretty extensive knowledge, not only of the habits of the plants themselves, but of soils also. But the normal condition of a plant is not to have its roots cramped in a pot. So, the cultivation of plants in pots must be entirely artificial in practice. One natural supposition of the amateur is, therefore, the richer I can get the earth in my pot, the better, and to this end he makes it fat with strong manure, or the larger the pot the better for the plant. Yet both these natural propositions are wrong in practice. A soil exceedingly fat tends to disease in plants, in artificial culture. A large pot tends to increase growth at the expense of bloom. A six inch pot is amply large for ordinary house plants. The soil should be pure, what is known as a sandy loam, enriched with none but the most thoroughly digested compost—that is, manure and soil so thoroughly seasoned, tempered and worked that rankness no longer exists. Again, the florist depends largely upon liquid manure to stimulate the plant when it needs it. For this there is nothing better in the West than blood or offal manure. To use this dissolve from one-quarter to one-half pound in a gallon of water. Give this on the surface, once a week or ten days, as the plants seem to need it, and in quantities only sufficient to moisten the soil of the pot, allowing so much soft, clear, tepid water from time to time as the plants may need. When guano is substituted, from one to two ounces will be sufficient, beginning with the smallest quantities and noting the results. If the fertilizers named are not easily procured, prepare a tight barrel with sticks and straw at the bottom, to form a receptacle for the liquid at the bottom, as in setting up a leach tub, set it where it will not freeze. Mix a peck of hen or pigeon manure, with sufficient barnyard scrapings to fill the barrel, well packed down, pour on rain water until it stands in the hollow at the top, and draw from the bottom from a plug as wanted, adding more water from time to time as needed. As you draw from the bottom, dilute properly and apply as before directed. In shifting from one pot to another use only a size larger than the plant had before. An easy way to proceed is to select the pot, cover the bottom with bits of crock or broken flower pots, cover this with sharp sand and rich compost, half and half. Put into the larger pot, one a size less than the one containing the plant, filling about it good compost earth well packed down. Lift out the pot and fill with earth, so the ball of earth with the plant to be placed thereon will reach to within a half inch of the rim of the pot. Set in the plant, press in the earth about it, and fill up with more soil if necessary, jar slightly to settle all firmly together, water, and the whole is as well done as possible, and in far less time than we have written it. If the plant has no ball of earth, the pot must have drainage as before directed, and filled with earth pretty firmly packed, so the neck of the plant—when the roots are spread—will just reach within half an inch of the top of the pot. Sift fine earth about the roots, pressing the soil well about them, filling only so full that when well settled it will be even with the neck of the plant or that portion at the old surface of the earth. Water and shade for a day or two and the plant should do nicely. To remove a plant from the pot in which it has been growing, turn the pot upside down upon the hand so the stem of the plant will come between the first and second fingers, covering the earth with the thumb and fingers. Strike on the bottom with the other hand, or jar the rim gently on some hard substance, and the ball entire will, as a rule, slip easily and intact from the pot. If the plant have a mass of roots next the side of the pot, trim them with a sharp knife as desired, and the whole is ready for re-potting. One thing should be remembered; liquid manure should not be given after re-potting until the plant is growing well, and the roots have filled the pots or nearly so. Thus a little observation and practical experience will soon enable the novice in floriculture to become expert.

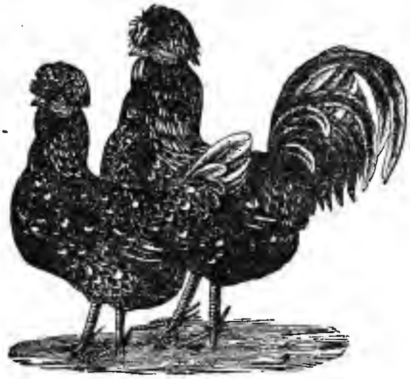
POUDRETTE. Poudrettes consist of blood, fish and animal matters, and night-soil, dried and combined with substances capable of deodorizing them and absorbing their ammonia, phosphuretted hydrogen, and other gases and moisture, and reduced to powder. A species of poudrette, fish manure, is prepared by steaming and pressing the fish, for the purpose primarily of obtaining their oil. The fish are steamed and subjected to strong pressure, by which the oil is forced out, and the residuum is left almost as dry as so much seasoned wood. It is then ground and packed in barrels for the market. All the poudrettes are packed in barrels or bags, and can be readily transported by land or water. When properly manufactured the poudrettes are very valuable manures. When applied to the roots of plants, in a soil well supplied with coarser manures, they give a vigorous start to young plants, and a larger development and a deeper tint to the petals of flowers. When applied in the hill they give to young plants a fine and early growth. They are rapidly decomposed in the soil, and should always be so deeply covered that their evolving gases may be retained by it. Poudrette should be used over a surface of ten or twelve inches square, rather than thrown in a mass around the seeds or roots of young plants. If the soil is cold, or the season backward, the good effect is soon manifest

It is with poudrettes as with other commercial manures; without a well attested affidavit of the constituent parts, they should never be purchased. This should show the nitrogen and phosphorus contained, especially since these are the valuable elements. Poudrette prepared from night soil has especially given dissatisfaction in many cases, it not being found as valuable as good barnyard manure. If the poudrette is made from fish, flesh, blood, and the tank stuff of rendering establishments, and thoroughly condensed, from 300 to 400 pounds per acre will be sufficient in connection with barnyard manure.

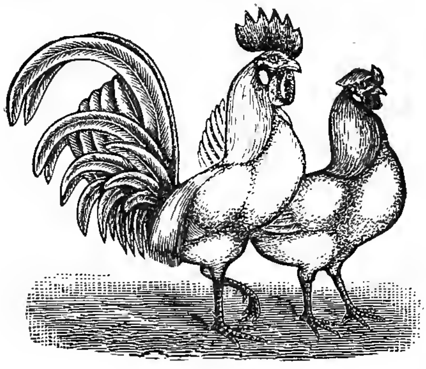
POULTICE. An external application employed for promoting the suppuration of tumors, or abating painful inflammation. The chief intention of the poultice is to retain the heat on the tumor for a sufficient length of time; consequently, corn meal and linseed meal are the best fitted for poultices. The fatty matter usually added is to give softness to the poultice, which is otherwise apt to harden as the moisture evaporates. Few farmers are aware of the value of these simple applications in abating inflammation, relieving pain, cleansing wounds, and disposing them to heal. The poultice may be rendered more soothing by opium, or in cases of foul ulcers powdered charcoal may be added. As an emollient poultice for grease and cracked heels, and especially if accompanied by much unpleasant smell, there is nothing preferable to a poultice of mashed carrots with charcoal. It is always best to enclose poultices in bags. Hot poultices are made with enough boiling water to bring them to a proper consistency. Hot poultices favor suppuration and should not be applied to fresh wounds. Cold poultices are made precisely as hot ones are, but allowed to get cold before using. A cold poultice of ripe cranberries is almost a specific in the earlier stages of erysipelas.

POULTRY. The term poultry is, strictly speaking, applied to the gallinaceous tribe. The French *poule* signifies a hen, and *poulet* a chicken. The Italian *polla* a chicken, and *pollame* poultry. In Latin *pullus* is a chicken, or other allied young animal. In its broad sense it is now used to designate all barnyard fowls, including ducks, geese, Guinea fowls, turkeys and peafowls. Since the days of improved breeds of poultry the industry has been vastly augmented, and various schemes have been devised for keeping them on a large scale, few of which have proved to be paying investments, and principally from the fact that the gallinaceous tribe, especially, require a wide range and plenty of exercise and pure air to keep them in health. Another class, who buy up young birds and fatten them for market, have succeeded better, and this would seem to be the true policy, since more than from 100 to 300 birds can not be profitably kept on the same range unless so divided up that they do not come in contact with each other. Even then they must be allowed to range partly at will, in which event they will be found to be great exterminators of insects, especially the young chicks. Particular care, however, must be taken with the young birds. They must be fully fed and the weaker ones protected from the stronger, else no after amount of stuffing will increase their frames. In relation to profits and increase two committees of the Massachusetts Agricultural Society, some years since, reported as follows: The Middlesex South committee give the following statements: Fifteen hens, mostly Leghorns and Black Hamburgs, laid in ten months 191 dozen eggs. Profits on eggs sold, chickens raised and sold, etc., $89.81; expenses, twenty bushels of corn, $24; net profit, $65.81. Fowls were allowed to run at large, and were fed well three times a day. Another lot of fifteen hens and one cock, mixture of Leghorn and native breed, laid 181 dozen eggs, which, with sixteen chickens, brought $66.78; expenses nine bushels of corn and six bushels of barley, $18.75; net profit, $58.03. Fowls run at large, fed twice a day in winter and once in summer. A flock of 113 Brahmas, in September, 1866, increased to 163 in one year, besides supplying eggs to the amount of $232.80; fowls sold, $75.28, making, with the fifty increase in flock, $408.08; expenses, $145.03; net profit $263.05, taking no account of the droppings of the chickens. The Bristol Central Committee recommend the Brahmas and Dorkings for the table; the Leghorns and Hamburgs for eggs; the Games and Dorkings, where all qualities are required of a high degree of excellence; and if pure breeds are not wanted, at least a game cock to improve the stock of every yard. When large numbers of fowls are to be kept, at least an acre must be allowed to each 100 hens, and if this is covered partially with brush so much the better. Constant care and vigilance are required, when keeping poultry in large numbers is followed. Tegetmeier, upon the subject of keeping poultry says: Fowls are either kept for the table or for eggs. In the former case, the object is to prepare the young birds so as to be fit for market at the earliest possible period. It is evident that they are not only better in quality, but that they realize a larger sum, if they are well fed; and as young birds have consumed a smaller amount of food, on account of their shorter lives, they must of necessity return a larger profit than older ones. Eggs, again, can only be produced by the hens out of the materials furnished by their food. A scanty supply of the former is therefore the inev-

BROWN LEGHORN HEN.

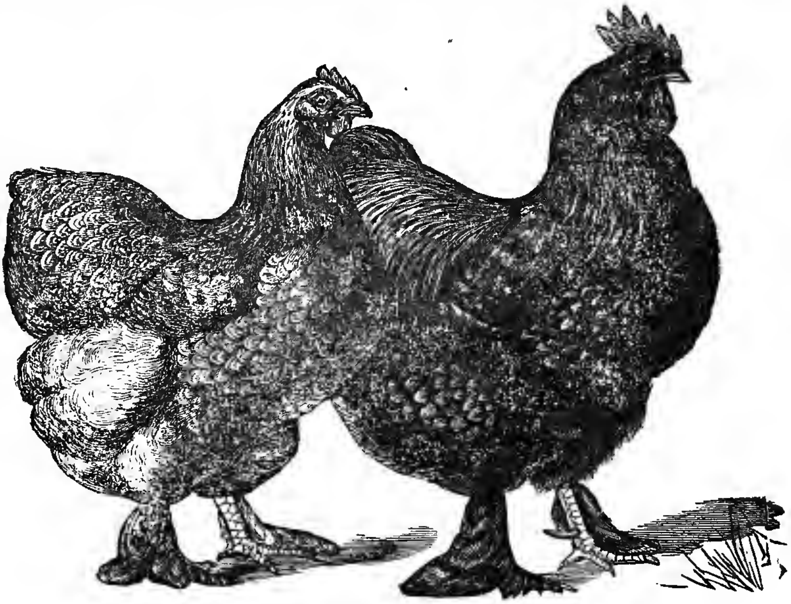

HOUDANS.

itable result of a short supply of the latter. In winter, when eggs are most valuable, this is particularly shown; for as there is then no insect or other food to be obtained by scratching, the production of eggs diminishes remarkably, unless the fowls are very well fed. As regards the number of times the stock fowls should be fed, we believe the most economical mode, when fowls have a free range, is to feed twice a day.



WHITE LEGHORN.

The fowls should be let out early in the morning; in fact, if there is no fear of foxes or other thieves, the hen-house had better be left open, so that the birds can come out at will. This they will do at daybreak, and, by wandering over the fields, secure a large amount of worms and insect food. They should receive their morning meal at a fixed hour: immediately after breakfast is usually a convenient time. It may be asked, how much corn should be given per head? We believe it to be quite impossible to give to that question an answer that would be of any practical value, so much depends on the size of the birds; it is obvious that a Dorking of ten pounds weight, and a Game fowl of five pounds, would require very different quantities of food. Again, the quantity must vary with the season of the year, much more being required to keep up the due amount of animal heat in winter than in summer. The work going on in the farm-yard, and the number of birds that are laying, will also influence the amount required to be given; for when a hen is producing eggs, she will eat nearly twice the amount of food that she requires at another time. The best rule, both as to quantity and time, is to give the fowls a full meal in the morning, and a second shortly before going to roost. Many persons feed their fowls only once a day, usually in the morning; the consequence is that they go to roost with empty crops, and as the nutriment they have collected during the day is required to keep up the animal warmth, particularly during the long cold nights of winter, it can not be employed in the production of eggs; thus feeding hens once a day is not favorable to their fertility. It is necessary, therefore, to feed liberally twice a day, if any large amount of profit be desired from fowls. There is one great advantage dependent on having fixed hours of feeding, namely, that the birds soon become accustomed to them, and do not hang about the house door all day long, as they do if irregularly and frequently fed. They consequently obtain a greater amount of food for themselves, and are less troublesome than they otherwise would be. If fowls have not a free range where they can obtain green vegetable food, a supply is indispensable to health, and it is as well to vary it if possible. In winter, a swede turnip may be cut across, and thrown down for them to peck at. In summer, cabbages should be supplied daily; or, what is still better, lettuces, especially those running to seed. The avidity with which these



PARTRIDGE COCHINS.

are devoured by fowls and turkeys is remarkable. Vegetable food may be advantageously cooked and mixed with meal, as a change. Small waste potatoes, boiled or steamed till soft, form a cheap and useful occasional food; but the fowls soon become tired of them, and they should only be used at intervals. In addition to wholesome and abundant food, a supply of clean water is indispensable. Some kind of fountain is often more convenient than an open vessel, in which the water is apt to become dirtied by the fowls. A very cheap and convenient contrivance of this kind may be made out of an earthenware jar and an ordinary glazed flower-pot saucer, by boring a small hole in the jar an inch and a half from the edge. When required for use, the jar is to be filled with water, and the saucer placed bottom upwards on the top. Both together are then to be turned quickly over, when the water will be found to flow into the saucer to the same height as the hole in the side of the jar. Some of the most successful rearers of chickens and pheasants are in the habit of administering to the young birds a chalybeate tonic in the water given them to drink; and they speak very highly of its good effects in those cases where broods are weakly, or where the young fowls are inclined to outgrow their strength. For this purpose an ounce of sulphate of iron (green vitriol) may be dissolved in a quart bottle of water, and two or three spoonfuls of this solution added to the water in the drinking-fountain, sufficient being supplied to give it a slight inky taste. The effect of this chalybeate on the health and vigor of the birds is very marked; their combs brighten in color, their appetite increases, and their general stamina is much improved. This mixture is practically identical with many of the poultry nostrums extensively advertised. Water fowl, ducks geese, etc., do not require large bodies of water as has generally been supposed. A small pond that may be kept clean in which they may bathe is all that is required, and even when there is no water save for drinking they do fairly well, when only a few are kept. Turkeys require and must have a considerable range, and they must also be allowed full liberty with their young after they begin to feather, else they will surely not be kept in good health. The same may be said of pea, and Guinea fowl. (See breeds under proper names; also, Poultry, in Supplement.)

POUND, LB. The avoirdupois contains sixteen ounces, and 7,000 troy grains. The troy pound twelve ounces and 5,760 grains. Also, an enclosure for cattle. In England a penal enclosure for trespassing cattle.

POUPART'S LIGAMENT. A tendinous expansion, running from the top, or *crista*, of the ilium to the os pubis, under which hernias protrude.

POVERTY GRASS. *Aristida dichotoma.* A grass growing on sterile places.

POWER. In mechanics, denoting a force which, being applied to a machine, tends to produce motion. A mechanical power denotes one of the six simple machines, viz: the lever, the inclined plane, the screw, the wheel and axle, the wedge, and the pulley. The mechanical horse power is estimated as being a force sufficient to raise 33,000 pounds to a height of one foot in a minute. This is the unit or standard by which steam engines and other prime motive force is measured, and is now in universal use for such measurements of applied force as relate to machinery.

POZZUOLANA. Volcanic ashes, used in making hydraulic cements.

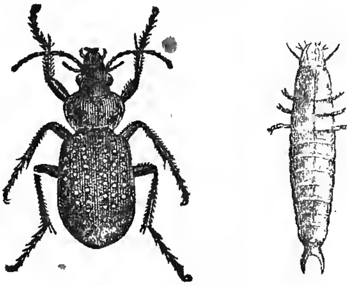
PRÆCORDIA. The fore part of the chest.

PRÆMORSE, BITTEN. Short thick roots which appear to have been bitten.

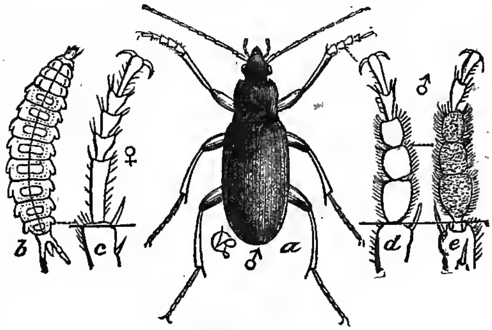
PRAIRIE. This name is given to the immense tracts of grass land occurring throughout the West. They are usually gently rolling or undulating lands, the grass of which is thickly matted, and from a few inches to three or four feet high, being most luxuriant in wet, swampy places. The prairie is often adorned with beautiful flowers in spring, and throughout summer and fall. The grass is of various kinds, some being of great value; the whole is, however, nutritious, and sustains cattle, horses, and sheep remarkably well.

PRECIPITATE. A solid matter thrown down in a clear fluid by chemical action.

PREDACEOUS BEETLE. The predaceous beetles are among the most beneficial in agriculture, since they prey exclusively upon insects, and principally on noxious ones. There are two principal classes of these, the predaceous ground beetles, the most useful, and the soft-winged predaceous beetles. In the first class we have the *Cicinelidæ* or Tiger beetles, and the *Carabidæ* or Ground beetles; the latter divided into a number of subfamilies. *Calosoma calidum*, (see cut), is one of the most useful of these, the beetle and larva of which is given above. The beetle is an inch in length, with three rows of golden dots on each wing cover, and is predaceous both in the larval and perfect state. This division of the subfamily Carabides embraces the genera *Carabus*, *Calosoma*, and

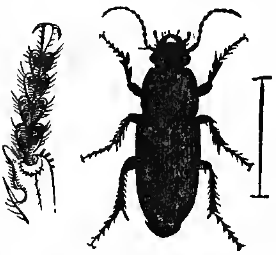


GROUND BEETLE AND LARVA.



CHALÆNIUS.

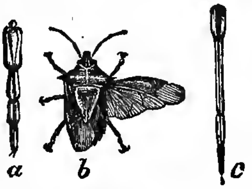
Cychrus. The preceding cut shows *Chalænius Pennsylvanicus*, of the subfamily Chalænides; *a*, male beetle; *b*, larva; *c*, *d*, *e*. front tarsus of male and of female magnified. Harpalus Pennsylvanicus is a nearly related species, as also is *H. caliginosus*. The family Harpalides embrace a very extensive group of beetles little inferior to all the other subfamilies noticed. They are black or dark metallic in color as a rule, and their size is limited in its range from a quarter of an inch to a little more than an inch in length. Their distinctive characters are difficult to determine except by an entomologist, and are omitted. In *Harpalus Pennsylvanicus*, however, we have shown the under side of the anterior tarsus of the male magnified, showing the two rows of scale-like papillæ, and near the end is the notch so characteristic of the anterior tibia of the tibiæ spurs at its upper angle as delineated by Dr. Riley. The Virginia Tiger Beetle (*Tetracha Virginica*) also belongs to the predaceous ground beetles, and the name well expresses their fierce voracity in their attacks on other insects. It is one of the insects attacking the Colorado Potato Beetle, and the larva also feeds upon insects, and indeed the larva of its own kind, if it find them. Another insect often mistaken for the Squash Bug, and thus destroyed, is the Spined Soldier Beetle, one of the most persistent in its attacks on the Colorado Potato Beetle, but feeding on various insects. The Plant Bug is squarer than the Soldier Beetle, and its beak is sharper and larger. The cut at *a*, shows the beak of the Soldier Beetle, *b*, the beetle, *c*, the beak of the Dotted-legged Plant Bug (*Euchistus punctipes*). The Plant Bugs should be destroyed and the Soldier Beetles protected wherever found for their services as exterminators of noxious insects.



HARPALUS PENNSYLVANICUS.

HARPALUS CALIGINOSUS.

VIRGINIA TIGER BEETLE.



SPINED SOLDIER BEETLE.

PREDISPOSING AFFINITY. Chemical affinity arising in the presence of three bodies, whereby a union is accomplished between two, which, without coming in contact with a third, would not readily unite.

PREGNANCY. (See Gestation.)

PRESERVING MEAT. (See Curing Meat.)

PRICKING OUT. Setting small plants in drills, etc.

PRICKLE. A sharp thorn, produced by a thickening of the bark or skin of the plant.

PRIMÆ VIÆ. The passage through the bowels.

PRIMARY ROCKS. The unstratified, crystalline rocks, as granites. Sometimes the transition slates and stratified rocks are included in this term.

PRIMINE. The outermost covering of the ovule; afterward it becomes the skin, or testa, of the seed.

PRIMROSE. Flowering perennials of the genus *Primula*.

PRISM. A solid contained by planes, of which two that are opposite are equal, similar, and parallel, and all the rest parallelograms. Prisms take particular names from the figures of their ends, or opposite, equal, and parallel sides. When the ends are triangles, they are called triangular prisms; when the ends are square, square prisms; when the ends are pentagonal, pentagonal prisms; and so on. A right prism has its sides perpendicular to its ends; an oblique prism is that of which the sides are oblique to the ends. The solid contents of a prism is found by multiplying the area of the base into the perpendicular altitude; hence all prisms are to one another in the ratio compounded of their bases and altitudes. The optical prism is of three similar sides.

PRISMATIC COLORS. Light passing through a prism is divided into seven colors, called the prismatic spectrum; these colors are, in their order, red, orange, yellow, green, blue, indigo, and violet. They have each peculiar properties.

PRESERVING WINTER FRUIT. The result of long and diversified experience in keeping fruit may be summed up in a single sentence: keep them dry, cool, and as nearly as possible from contact with external air. How to do this under ordinary circumstances, and with the facilities at command, is the question. For winter keeping they should be allowed to hang on the tree as long as possible, or, until there is really danger of their freezing, leaving those least affected by early frosts, and most tenacious in their habit of hanging late, to the last. When the fruit is perfectly dry and free from dew, and, on a cool day if possible, pick them by hand, placing them, a basketful at a time, into clean, sweet, dry, tight barrels, using the greatest care that they be not bruised; or, better, use a pouch or sack for picking in. Invert this in the barrel and turn them carefully out. Thus there is no possible chance of bruising the fruit. In this condition if they are entirely dry, cool, and sound, they may be immediately headed up, pressing in the head so there is no possibility of the fruit being shaken about—and wheeled to a cool, airy place in the barn, a shed or outhouse, where they may remain until hard weather. Above all things, avoid placing them where the sun will shine on the barrels, or where they may be subjected to considerable changes of temperature. When cold weather comes, they may be removed to a dry cellar, or, better, a fruit room,

Population of the United States, by States, Census of 1880.

Foreign.	Native.	Males.	States and Rank in the Union.	Population.	Females.	White.	Colored.
5,845	14,943	14,151	47 Wyoming	20,788	6,637	19,436	1,352
9,982	22,629	21,813	46 Idaho	32,611	10,793	29,011	3,600
11,515	27,610	28,180	45 Montana	39,157	10,977	35,446	3,711
16,022	24,419	28,202	44 Arizona	40,441	12,239	35,178	5,263
25,642	36,623	42,013	43 Nevada	62,265	20 252	53,574	8,691
15,861	59,259	45,977	42 Washington	75,120	29,143	67,349	7,771
9,932	108,498	63,751	41 New Mexico	118,430	54,679	108,127	10,303
51,793	83,387	82,302	40 Dakota	135,180	52,818	133,177	2,003
43 932	99,971	74,470	39 Utah	143,906	69,436	142,380	1,526
9,472	137,182	74,153	38 Delaware	146,654	72,501	120,198	26,456
30,440	143,327	103,388	37 Oregon	174,767	71,379	163,087	11,680
17,115	160,523	83,594	36 Dist. of Col.	177,638	94,044	118,236	59,402
39,780	154,869	129,471	35 Colorado	194,649	65,178	191,452	3,197
9,720	257,631	135,393	34 Florida	267,351	131,958	141,832	125,519
73,930	202,598	133,033	33 Rhode Island	276,528	143,495	269,931	6,597
40,946	291,340	166,888	32 Vermont	332,286	165,398	331,243	1,043
46,023	300,961	170,575	31 N.Hampshire	346,984	176,409	346,264	720
97,390	355,043	249,275	30 Nebraska	452,433	203,158	449,806	2,627
18,229	600,214	314,479	29 W. Virginia	618,443	303,964	592,606	25,837
129,804	492,879	305,886	28 Connecticut	622,683	316,797	610,884	11,799
58,869	590,076	324,084	27 Maine	648,945	324,861	646,903	2,042
267,699	513,107	419,262	26 Minnesota	780,806	361,544	776,940	3,866
10,295	792,269	416,383	25 Arkansas	802,564	386,181	591,611	210,953
292,680	572,006	518,271	24 California	864,686	346,415	767,266	97,420
82,648	851,984	462,004	23 Maryland	934,632	472,628	724,718	209,914
54,139	885,964	468,833	22 Louisiana	940,103	471,270	455,007	485,096
7,641	987,981	490,469	21 So. Carolina	995,622	505,153	391,224	604,398
109,705	886,261	536,725	20 Kansas	995,966	459,241	952,056	43,910
221,585	909,398	559,823	19 New Jersey	1,130,983	571,160	1,091,947	39,036
9,168	1,122,429	567,137	18 Mississippi	1,131,592	564,455	479,371	652,221
9,673	1,253,121	622,890	17 Alabama	1,262,794	639,904	662,328	600,466
405,417	910,063	680,106	16 Wisconsin	1,315,480	635,374	1,309,622	5,858
3,679	1,396,368	688,203	15 No. Carolina	1,400,047	711,844	867,478	532 569
14,667	1,498,139	745,839	14 Virginia	1,512,806	766,967	880,981	631,825
10,315	1,528,733	761,184	13 Georgia	1,530,048	777,864	814,251	724,797
16,582	1,525,881	769,374	12 Tennessee	1,542,463	773,089	1,139,120	403,343
114,516	1,478,058	838,719	11 Texas	1,592,574	753,855	1,197,499	395,075
261,488	1,363,132	848,234	10 Iowa	1,624,620	776,386	1,614,666	9,954
388,346	1,247,985	862,276	9 Michigan	1,636,331	774,055	1,614,078	22,253
59,471	1,589,237	832,676	8 Kentucky	1,648,708	816,032	1,377,187	271,521
443,093	1,339,919	858,475	7 Massachus'tts	1,783,012	924,537	1,764,004	19,008
143,765	1,834,597	1,010,676	6 Indiana	1,978,362	967,686	1,939,094	39,268
211,240	1,957,564	1,127,424	5 Missouri	2,168,804	1,041,380	2,023,568	145,236
583,592	2,495,177	1,587,433	4 Illinois	3,078,769	1,491,336	3,032,174	46,595
394,743	2,803,469	1,614,165	3 Ohio	3,198,239	1,584,074	3,118,344	79,895
587,533	3,695,253	2,136,635	2 Pennsylvania	4,282,786	2,146,151	4,197,106	85,680
1,211,438	3,872,372	2,506,283	1 New York	5,083,810	2,577,527	5,017,116	66,694

if such be had. Here the temperature should be kept as low and uniform as possible. Leave the cellar windows or ventilators open in winter, unless the temperature is such as to freeze the fruit; then, if warm spells intervene, close the ventilator at such times to keep out the heat. In spring close the windows during the day, and leave them open at night. In other words, when the weather is warmer out side than in the fruit room, keep the whole close, and *vice versa*. Fruit when confined in tight barrels, retains the carbonic acid given off by the fruit in the spaces between themselves. If the barrels are open, and especially if there be an excessive draft of air, the carbonic acid is forced out and the spaces supplied with air. This is what causes the apples to rot. The principal thing therefore to be avoided is, contact with air, undue heat and consequent sweating in the barrel. This last is not likely to occur if care has been taken in picking the fruit when cool and dry, and in packing and keeping the packages cool thereafter. We have seen it stated that if apples are packed in entirely dry barrels in which salt has been packed, they will be found sounder in the spring than in ordinary barrels. However this may be, salt barrels are not available except in isolated cases. Salt in a state of perfect dryness will take up a large amount of water, and hence such barrels may be of advantage when excessive sweating ensues. So, absolutely dry barrels will be indicated. The advantage of tight barrels, as previously stated, is that they retain the carbonic acid and exclude the air.

PRESERVING SMOKED MEATS. We do not consider the smoke house, as ordinarily built, to be the best place to preserve cured meats. Our July and August suns are generally so hot as to cause the fat parts to melt more or less, and this destroys the integrity of the whole. The very best way we know is to wrap the meat in thick brown paper, and enclose each piece separately in sacks made to fit. Sew tight; dip them in a preparation of slacked lime, of the consistency of ordinary paint. Then the pieces may be packed in barrels, with plenty of ashes, or better, pounded charcoal, and kept in a cool, well ventilated cellar, or in the coolest place in the barn. Another plan is to wrap in paper as before directed, then in an outer layer, and pack in barrels with some good absorbent. Still another plan is, after wrapping in thick brown paper, to pack in barrels with plenty of dry cut straw, examining them occasionaly to see they do not mold, if the weather is damp for any considerable length of time. By this plan, however, it is difficult to keep the meat from contracting mold if entirely excluded from light and air, and where light and air may enter insects and mold are pretty sure to follow. A smoke house built so as to prevent the admission of light, and at the same time insure ventilation and a degree of coolness so that the meat will not mold, may be had by placing it under the shade of a spreading tree. It should be built of brick, with an ample flue on top protected with blinds at the sides, and a wire gauze at the bottom to prevent the admission of insects, the gauze to be removed when smoking the meat. Another flue at the bottom protected with gauze allows the admission of air. Thus the house may be kept cool and well ventilated, and by throwing it entirely open occasionally at night, when dry, meat may be kept perfectly for a long time. This smoke house may be used for a variety of purposes, as for the keeping of ashes in districts where wood is used for fuel.

PRIVET. *Ligustrum vulgare.* A plant introduced from Europe, for the purpose of hedging, but now only used for ornamental hedges. It is hardy in the latitude of Chicago and is completely naturalized in the Eastern and Middle States and South. In the North, its leaves are killed after hard freezing weather sets in, but they remain attached to the branches sometimes nearly all winter. For ornamental hedging it is one of the prettiest of plants, its small glossy leaves producing a most pleasing effect. It stands the shears well, is of dwarf habit, and should be planted more than it is, in dry situations.

PROBANG. (See Choke.)

PROBE. A wire of silver, with a blunt or sharp point, used to ascertain the depth of wounds, sinuses, etc.

PROBOSCIS. A trunk, or nasal projection.

PROCESS. In descriptions, a tumor or eminence on a bone or part. A projection.

PROCUMBENT. Laying on the ground.

PROGNOSIS. A conclusion respecting the termination of a disease.

PROLAPSUS. A falling out or protrusion of any part of the body; as of the intestines, womb, etc.

PROLEGS. The imperfect legs of caterpillars; a wart-like tubercle.

PROMUSCIS. The suctional organ of the hemiptera.

PROPAGATING HOUSE OR PIT. (See Conservatory.)

PROPAGATION. Seeds are the most general means of propagation, but they do not perpetuate improved varieties, especially of fruits; buds do, however. Buds are propagated by budding, grafting, setting slips, cuttings, layers, offshoots, suckers, and in some plants, as the strawberry, by natural runners. The bulb is a peculiar bud, which propagates by offsets or buds. Tubers, or rhizomes, are underground stems, as in the potato, dahlia, flag, and they propagate the varieties also. Cuttings are portions of shoots, either of ligneous or herbaceous plants; and they are made of the young shoots with the leaves on, or of the ripened wood either with or without its leaves; and after they have, either in an herbaceous state with the leaves on, or with the wood mature, and with or without leaves, been properly prepared and planted, they form roots at their lower extremity, each cutting becoming a perfect plant. In general, cuttings should be taken from those shoots of a plant which are nearest the soil; because, from the moisture and shade there, such shoots are more predisposed to emit roots than those on the upper part of the plant. The young, or last-formed shoots, are to be taken in preference to such as are older, as containing more perfect buds in an undeveloped state, and a bark more easily permeable by roots; and the cutting is to be prepared by cutting its lower extremity across at a joint, the lenticels, or root-buds, being there most abundant. When the cutting is planted, the principal part of the art consists in packing the earth firm at the lower extremity, so as completely to exclude the air from the wounded section. Cuttings emit roots at this section, either in consequence of the action of the accumulated sap in the cutting, as in the case of the ripened wood in deciduous trees and shrubs; or in consequence of the joint action of the accumulated sap and of the leaves, as in the case of cuttings of soft wood with the leaves on, and in a living state. A few plants are propagated by cuttings of the leaves, the petiole of the leaf being slipped off from the parent plant, and probably containing the latent embryos of buds. Grafting and budding are processes which have been already explained. Inarching may be described as a species of grafting, in which the scion is not separated from the parent plant till it has become united with the stock. (See Grafting, Budding, etc.)

PROPEDS. The same as prolegs.

PROPHYLACTIC. Preventing disease.

PROPORTIONS, CHEMICAL. (See Equivalents and Atom.)

PROSENCHYMA. Elongated cellular tissue, as that of woody structures.

PROTEIN. The pure basis of the animal principles; it is separated from albumen, or fibrin, by dissolving them in caustic potash, and precipitating by acetic acid. It is gelatinous, gray; when dry, semi-transparent, and insoluble. It is a body of great interest, since in its combinations with sulphur, phosphorus, ammonia, etc., most animal tissues are formed.

PROTOTHORAX. The first segment of the thorax in insects.

PROTO-SALTS. Oxides; compounds, the bases of which are combined with but one equivalent of oxygen.

PROTOZOA. The lowest animalcules.

PROTUSILE. Capable of being protruded and withdrawn.

PROVENDER. Dry food. (See Fodder.)

PROXIMATE ANALYSIS. The separation of a compound organic body into its several complex parts, as the flour of wheat into starch, sugar, gum, fibrin, gluten, albumen. These are also called proximate principles. This kind of analysis is made by means of solvents, as alcohol, ether, water, potash, and acids; it is coarse and unsatisfactory.

PSEUDO. A common prefix, meaning false.

PTYALISM. Increased salivation.

PUBESCENT, PUBESCENCE. Covered with soft hairs.

PUCCOON. American alkanet. *Lithospermum canescens.* A perennial-rooted plant of the borage tribe, the root of which yields a red pigment, with which the Indians color themselves.

PUDDINGSTONE. A conglomerate.

PUDDLING. Ramming clay with sand and water until it is converted into an impervious mortar.

PUERPERAL. Relating to parturition.

PUFF-BALL. The genus *Lycoperdon* yields numerous puff-balls. The dust was at one time used to stop bleeding from wounds, as a styptic.

PUGGING. The stuff laid between floors to deaden sound.

PUGIL. A pinch of any stuff.

PULMONARIES. A kind of spider.

PULMONARY. Relating to the lungs.

PULQUE. The fermented juice of the Mexican aloe, (*Agave Americana*).

PULSE. Leguminous crops.

PULSE IN ANIMALS. The pulse of animals may be felt wherever a considerable artery passes over a bone. In cattle the pulse is soft and rolling, and in the horse full and rather tense, and when the pulse differs from this condition we may expect disease, or, if it be much slower or faster. If the pulse is rapid, full and hard, it denotes high fever, or acute inflammation; if it be rapid, but small and feeble, there is low fever, or loss of blood, or weakness. In brain diseases it is very slow, and in disease of the heart it is irregular, or at one time fast and again slow. In swine the pulse is felt by placing the hand at the left side next the heart; in sheep the same, or else when the femoral artery passes obliquely over the bone, about the middle of the inside of the thigh. In cattle it may be felt over the middle of the first rib, or beneath the tail. In the horse, it may be felt on the bony ridge extending upward from the eye, or on the lower jaw, just forward of the curved portion, and inside the elbow. The rapidity of the pulse of the adult healthy sheep is seventy or eighty beats a minute, or about that of man; in the ox from fifty to sixty, and in the horse about forty beats per minute, a state of rest being always implied. Hot, close stables, forced feeding, and when with young, always increases the pulse, and that of calves and colts will be about twice the rapidity of the adult animal, and the same is true of animals well advanced in old age. So, in determining the pulse, all these circumstances must be taken into consideration.

PULVILLI. The hairs, or a membrane, which covers the feet of some insects, enabling them to walk on the ceiling of rooms against gravity.

PUMICE. Porous lava. It consists of silica, 77.5; alumina, 17.5; potash and soda, 3.0; oxide of iron, 1.75.

PUMICED FOOT. In farriery, a wide-spread hoof, the sole of which is flat with the ground.

PUMPKIN *Cucurbita pepo.* Formerly the pumpkin was extensively cultivated for culinary use. Since the improvement in squashes they have been supplanted, and are now planted almost solely as food for farm stock, and usually among corn, often giving two or three good loads per acre in addition to the corn. The usual manner of planting is to drop a seed at every third or fourth hill, and every third or fourth row, at the first hoeing of the corn. Sometimes, however, the plants grow so vigorously as seriously to interfere with the late cultivation of the corn, and for this reason they are seldom cultivated in the West, except in localities where the corn is hoed by hand. The varieties usually planted are the Cheese Pumpkin, a variety strong and vigorous in its growth; the fruit much flattened, deeply and regularly ribbed, broadly dished about the stem; large, thick meated, and of good quality. The Connecticut Field Pumpkin is prolific, large, round, earlier than the Cheese Pumpkin, and is an excellent stock pumpkin. The Sugar Pumpkin is round, bright orange yellow, small, with a hard rind, prolific, and superior for pies, and always matures its crop, even in untoward seasons. The Canada Pumpkin is a sub-variety of the common field pumpkin. It is a hardy sort, adapts itself to a variety of soils, and ripens with surety.

PUNCHEON. A measure of eighty-four gallons.

PUPA. A nymph, grub, or chrysalis.

PUPIPARES, PUPIPARA. Those insects are said to be pupiparous which produce their young in the condition of a pupa or nymph, as the forest fly (*Hippobosca equina*).

PUPIVORES, PUPIVORA. The name of a tribe of hymenopterous insects, comprehending those of which the larvæ live parasitically in the interior or the larvæ and pupæ of other insects.

PURGATIVES. In farriery, such medicines as tend to evacuate the bowels by stool, and which are sometimes called cathartics. The purgatives most frequently employed for horses and cows are sulphur, jalap, aloes, gamboge, *Rhamnus catharticus*, and calomel. Saline purgatives are not often required; but when they are, Epsom salts (the sulphate of magnesia), is adequate for every purpose. Purgatives are less used now than formerly. Aloes is the best form of physic; but Epsom salts, linseed and olive oil, are sometimes used on certain occasions as laxatives with great propriety and benefit, and in gross, full horses, in some disorders of the stomach, liver, etc., but it should always be directed with caution. Violent purging or scouring, attended with inflammation, will sometimes arise when a horse is worked hard upon green food. The remedy is change of diet or less labor. Astringents should be used with much caution. It is probable an effort of nature to get rid of something that offends. A few doses of gruel will assist in effecting this purpose, and the purging will cease, without astringent medicine.

PURIFORM. Like pus.

PURLINE. In building, a piece of timber lying on the principal rafters to support them in the middle.

PURPURIC ACID. A red compound produced by the action of nitric acid on uric acid.

PURSIVENESS, PURSINESS. Shortness of breath.

PURSLANE. Pursley, pusley. *Portulacca oleracea.* A well known creeping plant said to be indigenous in the West, and universal as a weed, especially on warm, dry, sandy soils. It does not make its appearance until warm weather sets in, and is killed by the first general frost, springing readily the next season from seed. Once it gets a lodgment it usually retains it, since its growth is made chiefly after the cultivation of crops is over. It is much relished by swine, but should be exterminated so far as possible wherever found. Some of the cultivated varieties have beautiful flowers, white, pink, yellow and striped, both single and double, and once introduced spring annually from seed.

PUS, MATTER. A yellow, cream-like fluid formed in abscesses and from wounds. It contains globules, and is blood modified by inflammatory action. Healthy matter is that formed when a wound is healing kindly; unhealthy, is when the wound assumes a malignant form.

PUTAMEN. The shell of a fruit. The endocarp.

PUT LOGS. Short timbers used in scaffolding.

PUTREFACTION. The spontaneous decomposition of animal and vegetable substances, attended by the evolution of fetid gases. The putrefactive fermentation of animal substances is usually attended by more fetid and noxious exhalations than those arising from vegetable products. This appears principally referable to the more abundant presence of nitrogen in the former; and hence, those vegetables which abound in nitrous principles, such as most (if not all) of the cruciform plants, exhale peculiarly nauseous effluvia; hence, also, such animal products as are destitute of nitrogen, are either unsusceptible of what is commonly called putrefaction, or suffer it slowly and imperfectly. The formation of ammonia or of ammoniacal compounds is a characteristic of most cases of animal putrefaction; while other combinations of hydrogen are also formed, especially carburetted hydrogen, and sulphuretted hydrogen, together with complicated and often highly infectious vapors or gases, in which sulphur and phosphorus are frequently discerned. These putrefactive effluvia are, for the most part, easily decomposed, and resolved into new and comparatively innocuous compounds by the agency of chlorine; hence the importance of that body as a powerful and rapidly acting disinfectant. The rapidity of putrefaction and the nature of its products are, to a great extent, influenced by temperature, moisture, and access of air; they do not ensue below the freezing point, nor in dry substances, nor under the entire exclusion of oxygen; and hence, various means suggest themselves of retarding or preventing putrefaction, as well as of modifying its results. A temperature between 60° and 80°, a due degree of humidity, and free access of air, are the circumstances under which it proceeds most rapidly. The most effective antiputrefactives, or antiseptics, are substances which either absorb or remove a portion of the water or moisture, and enter into new combinations with the organic matter. The astringent or tannic principle of vegetables is also a powerful preserver of most organic tissues; it enters into chemical combination with the albuminous and gelatinous membranes and fibers; and the resulting compound, of which leather furnishes a characteristic example, is comparatively little prone to change, although the tanning material itself, as well as the animal principles with which it unites, are separately liable to decay. Among saline substances, the antiputrefactive powers of salt are commonly known: when a piece of flesh is salted, brine runs from it, in consequence of the energy with which the salt abstracts the component water of the muscular fiber: the flesh becomes indurated, and its susceptibility to putrefactive changes is greatly diminished; but it becomes at the same time less easy of digestion as an article of food.

PUTTY. In building, a fine cement of lime only. In glazing, a compound of linseed oil, and whiting.

PYLORUS. The passage or valve of the stomach into the intestines.

PYRITES. Native sulphurets of iron or copper.

PYRO. A common chemical prefix, indicating compounds modified by the action of heat, as pyrophosphoric, pyrotartaric acids.

PYROACETIC SPIRIT. A volatile, inflammable, and limpid fluid, formed by the distillation of acetate of lead. It is also called acetone.

PYROLIGNEOUS ACID. Acetic acid, procured by distilling wood. It contains creosote and other tarry compounds, but is extensively used to form solution of iron or red liquor for dyers. Its compounds are called pyrolignites.

PYROLIGNEOUS SPIRIT, PYROXYLIC SPIRIT. Hydrate of methylene, wood naphtha, a very volatile, inflammable fluid, from distilled wood. It is one of the most powerful antiseptics, but of unpleasant odor.

PYROMETER. An instrument for measuring degrees of heat above 600° Fahr.

PYROSIS. Acidity of the stomach, with a discharge of hot fluid into the throat and mouth.

PYROXENE. Augite.

PYXIDIUM. A fruit which splits into an upper and lower half, as that of the pimpernel. Pimpernel means two-winged.